73 AMATEUR RADIO

International Edition

FEBRUARY 1989
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A WGE Publication

Ten Reviews!

For home:

Two great HF rigs
FAX converter
10m vertical

For the road:

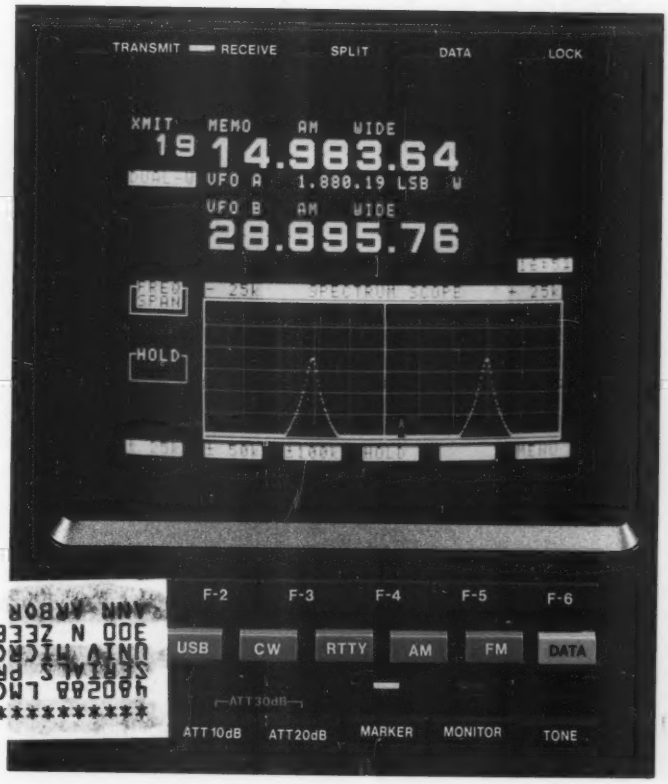
600-Watt amp
10m whip

Portable:

High-power HT
Pocket SW receiver
. . . and more!

Home-brew:

Plug-in C-64 packet
80m transceiver
Auto



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ICOM

IC-781 HF Transceiver

THE FUTURE OF AMATEUR COMMUNICATIONS

Once in a lifetime, a transceiver is introduced that's so extraordinary and innovative that it opens a totally new era in HF communications. ICOM's pacesetting IC-781 proudly exhibits that hallmark achievement with futuristic designs and features of true legendary proportions. Whether DX'ing, contesting, pioneering new interests or enjoying unquestionable top-of-the-line performance, the IC-781 is indeed today's standard of excellence!

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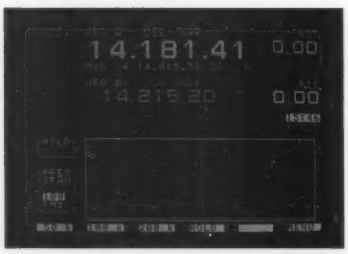

Dual Width Noise Blanker includes MCF filter plus **level and width controls** to eliminate pulse and woodpecker noise with minimum adjacent-signal interference.

Incomparable Filter Flexibility. Independent selection of wide and narrow SSB filters plus CW filters. Second and third CW IF filters are independently selectable!

Dual Watch. Simultaneously **receives two frequencies in the same band!** Balance control adjusts VFO A/B receive strength levels. You can check additional band activity, even tune in your next contact, while in QSO without missing a single word!

DX Rated! 150 watts of exceptionally clean RF output. Easily drives big amplifiers to maximum power.

Twin Passband Tuning with **separate controls for second and third IF stages!** Increases selectivity and narrows bandwidth, independently varies low and high frequency response, or functions as IF shift. **It's DX'ing Dynamite!**

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FOUR user selectable operating modes and a 90 number autodialer make Private Patch V the ONLY choice!

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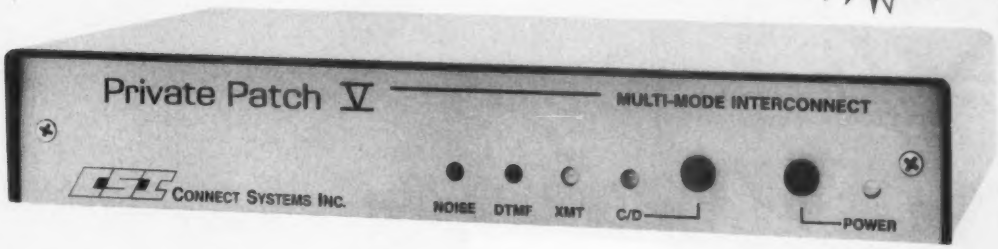

SELECT AN OPERATING MODE USING THE BUILT-IN KEYBOARD . . .

1. SIMPLEX SAMPLING PATCH

Private Patch V achieves a level of sampling patch performance unobtainable in any other product. Crucial to performance is the noise squelch filter. Compare our five pole filter to the competition's two pole filter. Advanced software algorithms perform noise correlation tests which result in greater useable range than the competition. Nine selectable VOX enhancement ratios allow you to vary performance from straight sampling to highly VOX enhanced. (sampling rate decreased while the land party is speaking). The mobile is in full control and can break-in at any time.

2. SIMPLEX VOX PATCH

VOX mode offers superb simplex operation with any radio, including synthesized and relay switched models. VOX mode has other advantages too. **1.** A linear amplifier can be used to extend straight simplex range. **2.** You can operate through any remotely located repeater to greatly extend range. **3.** If desired you can connect Private Patch V to the MIC and speaker jack of your radio. NO INTERNAL CONNECTIONS ARE REQUIRED. Control is maintained automatically with built-in dial tone detection, busy signal detection and fully programmable activity and time out timers. An optional electronic voice delay board eliminates first word clipping with slow switching radios.

3. DUPLEX PATCH

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Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

Group A

67.0 XZ	91.5 ZZ	118.8 2B	156.7 5A
71.9 XA	94.8 ZA	123.0 3Z	162.2 5B
74.4 WA	97.4 ZB	127.3 3A	167.9 6Z
77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
88.5 YB	114.8 2A	151.4 5Z	203.5 M1

- Frequency accuracy, ± .1 Hz maximum - 40°C to + 85°C
- Frequencies to 250 Hz available on special order
- Continuous tone

Group B

TEST-TONES:	TOUCH-TONES:		BURST TONES:			
600	697	1209	1600	1850	2150	2400
1000	770	1336	1650	1900	2200	2450
1500	852	1477	1700	1950	2250	2500
2175	941	1633	1750	2000	2300	2550
2805			1800	2100	2350	

- Frequency accuracy, ± 1 Hz maximum - 40°C to + 85°C
- Tone length approximately 300 ms. May be lengthened, shortened or eliminated by changing value of resistor

Model TE-64 **$79.95**

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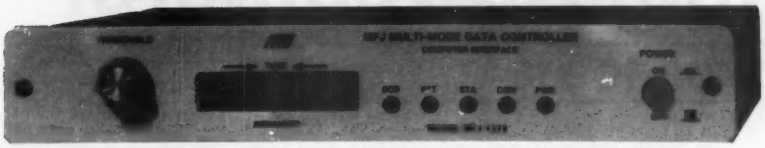
CIRCLE 10 ON READER SERVICE CARD

MFJ multi-mode data controller



9 modes for only . . . $249.95

Amateur radio's most versatile multi-mode data controller -- the MFJ-1278 --lets you join the fun on Packet, AMTOR RTTY, ASCII, CW, Weather FAX, SSTV, Navtex and gives you a full featured Contest Memory Keyer mode . . . you get 9 modes . . . for an affordable $249.95.

Plus you get MFJ's new **Easy Mail**™ so you and your ham buddies can leave messages for each other 24 hours a day.

You'll find it **the most user friendly of all multi-modes.** It's menu driven for ease of use **and** command driven for speed.

A high resolution 20 LED tuning indicator lets you *tune in signals **fast** in any mode.* All you have to do is to center a single LED and *you're precisely tuned in to within 10 Hz* -- and it shows you which way to tune!

Plus you get 32K RAM, KISS for TCP/IP, high performance HF/VHF/CW modems, software selectable dual radio ports, 32K RAM, AC power supply and more.

All you need to join the fun is an MFJ-1278, your rig and any computer with a serial port and terminal program.

You can use the MFJ Starter Pack to get on the air instantly. It includes computer interfacing cable, terminal software and friendly instructions . . . everything you need to get on the air fast. Order MFJ-1282 (disk)/MFJ-1283 (tape) for the C-64/128 and VIC-20; MFJ-1287 for Macintosh; MFJ-1284 for the IBM or compatible, $19.95 each.

Packet

MFJ's new generation packet mode gives you genuine TAPR software and hardware plus many MFJ enhancments like Easy Mail™.

A new Kiss interface makes the MFJ-1278 TCP/IP compatible.

Extensive tests published in **Packet Radio Magazine** ("HF Modem Performance Comparisons")prove the TAPR designed modem in the MFJ-1278 gives better copy with proper DCD operation under all tested conditions than the other modems tested.

New AMTOR mode!

Now the MFJ-1278 has a new AMTOR and Navtex mode, making it the only controller to feature **nine** digital modes.

MFJ-1278 transmits and receives AMTOR and includes all AMTOR modes: ARQ (Mode A), FEC and MODE S (Mode B).

Baudot RTTY

You can copy all shifts and all standard speeds including 170, 425 and 800 Hz shifts and speeds from 45 to 300 baud. *You can copy not only amateur RTTY but also press, weather and other exciting traffic.*

You can transmit both narrow and wide shifts. The wide shift is a standard 850 Hz shift with mark/space tones of 2125/2975 Hz. This lets you operate MARS and standard VHF FM RTTY.

ASCII

You can transmit and receive 7 bit ASCII using the same shifts and speeds as in the RTTY mode.

CW

You get a Super Morse Keyboard mode that lets you send and receive CW effortlessly, including all prosigns -- it's tailor-made for traffic handlers.

A huge type ahead buffer lets you send smooth CW even if you "hunt and peck".

You could store entire QSOs in the message memories, if you wanted to! You can link and repeat any messages for automatic CQs and beaconing. Memories also work in RTTY and ASCII modes.

***A** tone Modulated CW mode turns your VHF FM rig into a CW transceiver* for a new fun mode. It's perfect for transmitting code practice over VHF FM.

An AFSK CW mode lets you ID in CW.

You also get a random code generator that'll help you copy CW faster.

Weather FAX

You'll be fascinated as you watch WEFAX signals blossom into full fledged weather maps on your Epson or IBM graphics compatible printer.

Automatic sync and stop lets you set it and leave it for no hassle printing.

You can save FAX pictures and WEFAX maps to disk if your terminal program lets you save ASCII files to disk.

Pictures and maps can be saved to disk or *printed to screen in real time or from disk if you have an IBM or Macintosh* with the MFJ Starter Pack.

You can transmit FAX pictures right off disk and have fun exchanging and collecting them.

Slow Scan TV

The MFJ-1278 introduces you to the exciting world of slow scan TV.

You can print slow scan TV pictures on any IBM or Epson graphics compatible printer. If you have an IBM or Macintosh you can print to screen and save to disk with the MFJ Starter Pack.

You can transmit slow scan pictures right off disk. If your terminal program lets you save ASCII files you can save pictures from over-the-air QSOs.

You can transmit and receive 8.5, 12, 17, 24, and 36 second black and white format SSTV pictures using two levels.

Contest Memory Keyer

***Nothing** beats the quick response of a memory keyer during a heated contest.*

You'll score valuable contest points by completing QSOs so fast you'll leave your competition behind. And you can snag rare DX by slipping in so quickly you'll catch everyone by surprise.

Message memories let you store contest call, name QTH, rig info -- everything you used to repeat over and over.

You get iambic operation, automatic incrementing serial numbering, weight control to penetrate QRM and more.

More Features

Turn on your MFJ-1278 and it sets itself to match your computer baud rate. Select your operating mode and the correct modem is automatically selected.

Plus . . . printing in all modes, threshold control for varying band conditions, tune-up command, lithium battery backup, RS-232 and TTL level serial ports, watch dog timer, FSK and AFSK outputs, output level control, speaker jack, key paddle jack, test and calibration software, Z-80 at 4.9 MHz, 32K EPROM, and socketed ICs. FCC approved. 9x1½x9½ in. 12 VDC or 110 VAC.

Get yours today and join the fun crowd!

New Firmware Update

A new KISS/AMTOR/Navtex Firmware update is available to MFJ-1278 owners.

MFJ's powerful update is the most reasonably priced mulit-mode upgrade by any manufacturer. Contact your dealer or MFJ for yours today!

MFJ Packet Radio

MFJ-1274 $139.95

MFJ-1270B $119.95

MFJ-1270B super clone of TAPR's TNC-2 give you more features than *any* other packet controller -- for $119.95.

You can double your fun by operating both VHF *and* HF packet because you get **high performance** switchable VHF/HF modems.

You get MFJ's new **Easy Mail**™ with soft-partitioned memory so you and your friends can leave messages for each other 24 hours a day.

In MFJ's new WeFAX mode you can print full fledged weather maps to screen or printer and save to disk using an IBM compatible or Macintosh computer with an MFJ Starter Pack.

A new **KISS** interface lets you run **TCP/IP.** They also come **NET ROM** compatible -- ***no modification needed!***

You also get 32K RAM, a full one-year unconditional guarantee and you can use 12 VDC or the included 110 VAC power supply.

For dependable HF packet tuning, the **MFJ-1274** gives you a high resolution tuning indicator that's accurate to within 10 Hz -- and it's only $20.00 more.

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CIRCLE 24 ON READER SERVICE CARD

Welcome, Newcomers!

Reviews

Have you seen the film *Moscow On The Hudson?* In it, Robin Williams plays a Russian emigre who ends up in New York City. Soon after arriving in America, he goes to a supermarket and timidly pokes around. Having come from a land where even the staples aren't always available, the selection of food boggles him. **Front-end overload** sets in by the time he gets to the coffee section. He reaches for a package, knocks over a few other products—and passes out cold!

Drama aside, the example should be clear: newcomers to amateur radio can be easily cowed by the wide selection of gear. In 1988 alone, ICOM, Kenwood, and Yaesu presented nearly twenty new **transceivers**. In the past year, well over a hundred amateur radio products entered the market. It's as challenging now to shop wisely as it is to **home-brew** equipment.

Enter *73*

73 Magazine's answer to this is simple—a more aggressive product review program. We aim to run at least six reviews per issue, up from the average of two or three. We also plan a special review issue every year, which will feature product reviews of at least ten of the more popular items on the market.

Your feedback—what else?—prompted us to take this step. This demand was second only to "more home-brew." This still doesn't cover it all, of course, but it's a much-needed step in the right direction.

Our reviews are geared more for the operator than the tech purist. You won't have to wade through exhaustive, and exhausting, discussions of circuit particulars. Nor will you be distracted by graphs showing a transceiver's transmission **spectral purity.** If a **rig** meets **FCC** specs in this area—as virtually all modern rigs do—we just say so. We also don't take up valuable space with complete comparative listings of the manufacturer's specifications versus observed specifications. Most discrepancies are minor and can be effectively covered in a sentence or two.

Relevance

73 reviews focus on the practical issues: Whom would the product interest the most?—**DXers, digital mode** enthusiasts, or the Saturday-afternoon **rag-chewer?** How difficult was it to put the product together and get it up and running?—Is it entry-level or not? Is a piece of gear with operator controls **ergonomically** well-designed? Does the product perform according to the manufacturer's claims? Are the instructions clearly written, or clearly translated? Do they include plenty of graphics? How supportive is customer support? How does the piece of gear compare with similar products? How adaptable is it to other uses?

Last but not least: Where is there room for improvement? I think you'll find our reviews don't spare constructive criticism. The manufacturers respect this. They know they need your feedback in order to continue improving their line. They can no more afford to live in an ivory tower than we here at *73*.

Good luck! 73

. . .de NS1B

Are You a Potential Reviewer?

If this is something that interests you, send for our reviewer profile form. In it, we ask you to rate our review policy, and to tell us a bit about yourself as a ham, such as your favorite modes and bands, your station setup, and what writing, if any, you have done. When you receive it, just fill it out and send it back to us. You can also find this form on Compuserve's Hamnet. Feel free, also, to leave us a message on CompuServe (CS 73170,775), MCI Mail, (WGEPUB), or GEnie (BHASTINGS.3). Looking forward to hearing from you!

GLOSSARY

Amplifier—A device that increases the magnitude of a signal, usually with minimum affect on the signal's waveform.

Digital mode—A radio wave onto which information has been imposed with discrete states or levels, rather than with a continuously variable range. Morse code is a digital mode since all of the information it conveys is represented by only three units ("dits," "dahs," and spaces).

DXer—A ham who specializes in making long-distance contacts.

Ergonomics—Refers to the interfacing of an operator to a piece of equipment. An ergonomically well-designed piece of gear has controls that are sensibly and conveniently placed.

FCC—Federal Communications Commission. This is the government agency that regulates the allocation and use of radio frequency spectrum in the US.

Front-end—This refers to the amplification stage of a receiver that meets the incoming wave energy from the antenna system. Too much wave energy can cause the front-end to overload, causing wave distortion and blockage, and the production of unwanted wave products.

Hand-held—A transceiver that can be held and operated in the user's hand.

HF—High Frequency. This is a part of the radio frequency spectrum in which most worldwide amateur communications take place.

Home-brew—Home-built.

Rag-chewer—An amateur who enjoys conversing at length on the air.

Rig—A piece of amateur radio equipment, usually a transceiver.

Spectral purity— Refers to the spectral map of all the wave energy emitted in a transmission. The greater the proportion of total energy contained in the signal in the principal (fundamental) transmitted frequency, the greater the spectral purity.

Transceiver—A piece of radio equipment in which the receiver and transmitter are contained in the same chassis.

QRM

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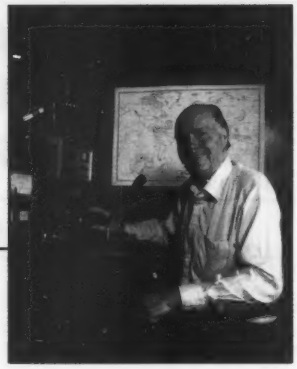
Photography by Suzanne Torsheya

Number 2 on your Feedback card

NEVER SAY DIE

Wayne Green W2NSD/1



The Military Will Save Us!

Welcome again to the Green Gloom Guide wherein I blow another Pollyanna ham shibboleth out of the water—to mix my metaphors. I sure wish my gloom bulletins would stop proving right.

In the past, one justification for a tiny group like ours (amateurs) to hold on to such an enormous number of incredibly valuable and desperately needed radio frequencies was that in time of war these would become an irreplaceable military resource. This was, when originally planned, an excellent idea.

Within hours of our entering WWII, our ham bands were closed and turned over to the military. I was there, operating on 160m, that fateful December 7th, 1941. In fact, it was a W8 in Stacy Basin, NY, who told me first about the attack on Pearl Harbor. Little did I realize that a few months later I'd be on my way to the Pacific to fight Japan from a submarine.

I wasn't around for WWI, so I don't know what they did with the ham bands then, but I do know that many of them were used by the military in WWII. My SD radar used the old 2½meter ham band—112–116 MHz. It had an antenna on a periscope mast which I could stick out of the water while we were submerged to check for planes before we surfaced. It didn't take long before the Japanese equipped their planes with 112 MHz receivers and used the SD signals as beacons. By late 1943 we'd pretty much stopped using this magical aircraft magnet. The newer 3 GHz SJ radar was higher than the Japanese could build receivers at the time, so we used that instead. I never saw any sign that the Japanese could pick up the SJ radar at any time during 1944 and right up until the end of the war in 1945. Using this radar I was able to guide my submarine on the surface at night right down through the middle of Japanese troop convoys. No, they definitely couldn't tune 3 GHz then.

In past decades when the FCC has rattled their sabre, threatening to lop off part of a ham band, the military has been right there protecting our (their) frequencies. That support helped many times.

So where's the cavalry now, when 40% of our 220 band is being chopped off? There's a curious silence from the Pentagon. Well, not so curious, if you really think about how technology has changed since WWII. You have noticed some changes, right? Well, maybe not in the ham bands, but if you have been keeping up with the technical journals you're aware of how many light-years we hams are behind the cutting edge of communications technology. Up until the League's blessed Incentive Licensing disaster 25 years ago we were up front.

Times are a 'Changin'

Frankly, I don't think we're going to get much support from the military anymore—and I'll tell you why. First, when we entered WWI and WWII our country had a couple of years leeway to get its act together. We needed it. The radio equipment we were making for the military in 1941 had largely been frozen in design in 1935 and was virtually antique while it was being churned out by the zillions.

Green's exaggerating again, right? In the summer of 1942 I worked as an electronic technician in Building 89 at the GE plant in Schenectady. We were building the BC-191 and BC-375 transmitters. They were identical except for power voltage. They were enormous kluges. The Army used them in staff cars and as portable transmitters. They were eventually superseded by the SCR-274N Command Set rigs which were about 1/10th the size and far more stable.

Lacking frequency synthesizers, one needed a frequency standard to find a particular frequency. When I first reported on my

Continued on p. 8

QSL OF THE MONTH

To enter your QSL, mail it in an envelope to *73*, WGE Center, 70 Rte. 202 N., Peterborough NH 03458, Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to *73*. Entries not in envelopes cannot be accepted.

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Never Say Die

Continued from p. 6

submarine, two of my communications receivers were still old regenerative jobs from the early 30s. . . the old RAX-7 and RAL-7. The LR1 frequency standard on my sub had 90 tubes and weighed in at nearly a hundred pounds. We used that until the end of the war.

To keep communications confidential we used a special typewriter-like device, the ECM, which encrypted and decrypted messages automatically. It was invented by the Germans. Today that's all done by computer and built right into most equipment.

Today's military communications equipment has to be made so any idiot can use it. This means as little tuning as possible. . . and that means fixed, standard channels. Even the military have discovered that no system is going to work in an emergency if it isn't working on an every-day basis. The bottom line is that today's military equipment is designed to work on today's military frequencies, not on our ham bands. And it doesn't seem to fit many war-game scenarios for the military to plan on having two years to train new technicians and build a whole new type of equipment which might make our bands of some value to them.

There are two basic war potentials the military have to plan for. One is a nuclear attack, in which case we essentially have no real plans. The other is a repeat of limited wars such as we fought in Korea and Viet Nam. We haven't much stomach for those "little" wars, so they're unlikely.

Little wars would be fought with what's being used at the time. It's unlikely that if we got sucked into a war in Iraq or Sri Lanka that we hams would be put off the air or that our military would do anything more than place some big radio contracts with Japan or Korea.

Our ham bands seem to be largely obsolete as a military resource. Technology has passed us by there, too. No, if we're going to try and hold on to our bands we've got to face the responsibility involved and stop lying to ourselves. We've got to show that we're worth a national investment of hundreds of billions of dollars in what are now almost totally unused microwave ham frequencies.

I wasn't exaggerating when I humorously wrote about selling our bands and pocketing the money. Of course, they're not ours to sell, but if they were, the relatively few hams who are using the 220–222 MHz part of the band could easily pocket several million dollars apiece.

In the recent past we've seen the loss of 80 MHz on the 2300 band, 25 MHz on the 1200 band, the top half of 160 is going, 10 MHz on line A from the 420 band, and now 40% of the 220 band. Whew, tell me when you think I'm right and that we should start to do something. That "we" means YOU and not some vague other group.

"Our ham bands seem to be largely obsolete as a military resource. Technology has passed us by there, too."

Building Support

Using amateur radio and an understanding of the real power conduits in America, we have the potential for affecting the entire world. We all know that technology is the future—we see that at every turn. Few jobs in America today don't involve computers. Most involve the telephone, facsimile, and information. Any country which falls behind in technology is going to be a poorer country. Look at the power television and the print media have over the whole world!

I brought my message on solving America's problems to the people of New Hampshire and they responded with a solid vote for me as Veep. Thank heavens Bush didn't take this seriously. The Veep job is terrible—not one I'd ever want. I believe I can get more done where I am than I could sitting in Quayle's office. Well, with your help I can.

How can we get more *73* subscribers? With your help and support we can get your ham club members to subscribe. You can run *73* subscription booths at hamfests and conventions. You can give gift subscriptions to your friends and get them aboard. With less than 100,000 subscribers, I'm not going to be able to be very effective.

You know, it's absolutely amazing what you can get done when you decide to do something. You can stop smoking. You can lose that weight you need to. You can stop the FCC from taking away our bands. You can get your city or town to make substantial improvements in education. You can motivate your own kids or grandchildren to excel. You can get your state to make some desperately needed changes in education. You can even be a big factor in getting the federal government to make needed changes. I'm not exaggerating—when you know how to do these things and make up your mind to get them done, nothing can stop you.

For instance, we're in the process of losing 40% of the 220 band. We all know that once we lose a band that's the end—we're never going to get a chance to get it back. Amateurs in the past have either allowed us to lose bands or have actually been paid off to let them go—and there's a lot of evidence that we were sold down the river by some former trusted ham officials.

Just in my ham memory we've lost much of the 1815–2050 kHz band, allowed short-wave broadcasting to take most of our 40m band, and lost 14350–14400 kHz and 29.7 to 30.0 MHz. Just before I got active in hamming we'd lost 7.3 to 8.0 MHz and 14.4 to 15.0 MHz. We've gained some little slivers from WARC—and the 15m band, so it hasn't been all downhill.

We've recently been given a 900 MHz band, but lacking anyone to use it, the likelihood is that it'll be blown away before we ever get around to doing anything about it.

The FCC says we have about 400,000 licensed hams. Surveys indicate that at best only half of these are even remotely active or read any ham magazine. That gives us a total pool of perhaps 200,000. Can we get half of the "active" hams to read *73* so we can start moving the world? You tell me. Start asking your friends and see what it's going to take. I'll make *73* any way you want it that you think will work. I can't make it both more technical and simpler. I can't be both pro and anti-ARRL. By the way, I give the FCC a bad time when I think they are doing wrong. I do the same for the ARRL. I'm not anti-FCC or anti-ARRL. That's a silly simplification with no basis in reality.

A New League?

I was approached by a ham industry chap the other day who is starting a new national ham organization and wanted my help. Just what we need, another way to split the hobby wide open. He and another manufacturer seem to feel that there is enough frustration with the ARRL that they can build a new national club. There's nothing wrong with the ARRL that replacing those old traffic men directors who are running it won't cure. We don't need a new national organization. And we particularly don't need one controlled by two ham industry people who have a lot to gain personally. The good old greed factor, I suspect.

If you can help me get 100,000 subscribers (and that's less than *QST* has), I'll give you the biggest ham magazine every month and together we'll change America and then the world. I've got the lever, I just need you to help me push it. Are you with me?

Veeping

Okay, you've got Dan Quayle as the vice president. I heard the other day that the real reason Bush chose Quayle was as an insurance policy to make absolutely sure he doesn't get assassinated. I suspect he's made his Secret Service bodyguards obsolete. Clever move.

Last year, on my 65th birthday, I announced for the vice presidency in the New Hampshire primary election. I'd done this on a lark in 1964 and found that I got a good deal of attention. The attention was amusing in 1964, but I had no practical use for it.

This time I had what I thought was a powerful message—one about getting America back to #1 in the world, with one of the key elements being a rebirth of amateur radio as a way to get millions of youngsters really interested in technology.

My running for the vice presidency was tongue-in-cheek, as I made clear. But my message was serious. Unlike the presidential candidates, I had some proposals for solving the many problems facing our country—problems we must solve if America is going to regain its world technological and financial strength.

I've written about these ideas in my past editorials. Many of the

Continued on p. 65

QRX . . .

EDITED BY BRYAN HASTINGS NS1B

Mir Miru = Peace To The World

Did you know that the Russian word *mir* means both "peace" and "world"? It seems an apt name for a space station that orbits the globe for the peaceful intent of space exploration and colonization. International amateur radio contacts between the cosmonauts and terrestrial stations adds to the peaceful pursuits of *Mir*.

The three cosmonauts on *Mir* since the fall of 1988—Vladimir Titov, Musa Maranov, and Vladimir Polyakov—all have callsigns and operating privileges on the ham bands. Their calls are U1MIR, U2MIR, and U3MIR, respectively. They operate 2 meter FM, using a Yaesu FT-290, and a ¼-wave whip mounted outside on one of the craft modules. You are most likely to hear them on the air between 0500–1000 GMT, and on any frequency between 145.4–145.6 MHz. They are often on 145.55 MHz simplex, and on duplex with the uplink frequencies 20–30 MHz on either side of 145.55.

Those who have worked *Mir* can QSL direct to: B. Stepanov UW3AX, PO Box 679, Moscow 107207 USSR.

Satellite Blow-out Issue!

Andy MacAllister WA5ZIB, our "Hamsats" columnist, has decided to take on the job of coordinating the May 1989 Super Satellite Issue. He will amass all the hamsat-related articles for this issue.

We are fortunate that Andy has taken on this task, as he is ideally suited for it. Andy sits on the Board of Directors for AMSAT-NA, North America's premier organization devoted to hamsat activity. This is going to be a blow-out issue, with 45–50 pages of hamsat-related articles, from home-brewing to contesting to tutorials. Any readers interested in contributing to this issue should contact Andy at: 14714 Knightsway Drive, Houston TX 77083. Make sure to get all editorial materials to him by 15 February!

Changing of the Guard

Pete Putman KT2B, our "Above and Beyond" columnist of 3-½ years, is taking a hiatus from amateur radio. His last column appears in this issue. We are sorry to see him go, as he was one of our most prolific writers, and his column was very popular. Yet we understand—now he's focusing on family and the development his A/V presentation business!

Chuck Houghton WB6IGP, a guru on microwave operations, is the new "Above and Beyond" columnist. His column will debut in March. He has written a number of articles for amateur radio journals, focusing on microwave home-brew. He has been a microwave technician for Pacific Bell for 24 years, and has worked extensively on both analog and digital systems in the 2–12 GHz range. He is no stranger to VHF and UHF, having extensively worked on 150 MHz services and 450 MHz mobile radio systems. Chuck is also very active in the San Diego Microwave Group.

Chuck welcomes any microwave-related questions from the readership. His address is: 6345 Badger Lake, San Diego CA 92119.

Oops

There is a small correction to the ICOM 32AT dual-band handheld review that appears on page 68 of the December 1988 issue. The HS-10 headset does, in fact, work with this HT.

Weather Satellite Handbook

73 Editorial still receives many calls from people relating to Ralph Taggart's *Weather Satellite Handbook*. Ralph, for the time being, is not an Associate Editor with the magazine. Questions about his book should go directly to him at: 602 S. Jefferson, Mason MI 48854.

License Figures

Novice Enhancement should be renamed Technician Enhancement, based on FCC licensing statistics recently released. They show that the Technician class license is the fastest growing of any class in the history of the U.S. Amateur Service. The specific growth figures for October 1, 1987 through September 30, 1988 are:

Technician	+8.70%
Extra	+6.80%
Advanced	+0.21%
General	−1.26%
Novice	−3.68%

This provides for an overall growth in the amateur service of 1.54% in the past 12 months.

For the second consecutive year, this second level of the amateur radio licensing ladder shows the greatest growth. If this trend continues for the next several years, Techs may well be the most populous class of license.

CW Washed Up?

Emergency and distress messages sent using Morse code and human operators will be gone from the high-seas by 1993! This is the decision of the International Maritime Organization—a United Nations agency for safety of shipping and prevention of pollution by ships on the seas. The traditional "SOS" sent by Morse code is being replaced by the new and highly sophisticated Global Maritime Distress and Safety System which transmits and receives messages automatically. The computer-based communications system uses satellite intertie. With the new system, any person need only push a single button to send a worldwide message that contains all data needed to affect rescue.

In addition to the main GMDS system, ships will carry self-powered radio beacon transmitters designed to float freely and transmit an exact position in case a ship sinks without warning. A spokesman for the International Maritime Organization says that as soon as the new system is operational, shipboard radio operators and their gear will be phased out.

The decision to completely abandon Morse code as a maritime communication tool is bound to have repercussions in other services, including amateur radio. One of the many services hams have prided themselves on is the interception and accurate relay of maritime distress messages to the Navy, Coast Guard, and other rescue agencies. The move to this high-tech maritime rescue system will give more leverage to the growing number of voices calling for the abolition of CW as a requirement in obtaining an amateur license. With growing evidence of the failure of Novice Enhancement, the current mood in United States amateur radio political circles seems to be toward some form of entry-level code-free license.

TVRO

A US District Court in New Jersey overturned a restrictive home satellite dish zoning ordinance by the town of Maplewood that would have unreasonably impaired the installation and use of home TVRO systems. In its decision, the court cited the 1986 FCC preemption that prohibits local municipalities from unfairly restricting home dish installation and use. The Maplewood ordinance restricted antenna height to six feet and placed land-

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The DCL system searches for an open channel, remembers it, returns to the original frequency and transmits control information to another DCL-equipped station that switches **both** radios to the open channel. Microprocessor control assures fast and reliable operation. The whole process happens in an instant!

Actual size front panel

Optional Accessories

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- **MU-1** DCL modem unit
- **VS-1** voice synthesizer
- **PG-2N** extra DC cable
- **PG-3B** DC line noise filter
- **MB-10** extra mobile bracket
- **CD-10** call sign display
- **PS-430** DC power supply for TM-2550A/2530A/3530A
- **PS-50** DC power supply for TM-2570A
- **MC-60A/MC-80/MC-85** desk mics.
- **MC-48B** extra DTMF mic. with UP/DWN switch
- **MC-43S** UP/DWN mic.
- **MC-55** (8-pin) mobile mic. with time-out timer
- **SP-40** compact mobile speaker
- **SP-50B** mobile speaker
- **SW-200A/SW-200B** SWR/power meters
- **SW-100A/SW-100B** compact SWR/power meters
- **SWT-1** 2m antenna tuner

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Specifications guaranteed on Amateur bands only.

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scaping, set-back, and other restrictions on the homeowner.

Gateways Needed For AO-13

OSCAR gateways are needed for educational purposes. AMSAT-NA Science Education Advisor Rich Ensign N8IWJ is compiling a list of stations which can gateway OSCAR-10 and OSCAR-13 to local repeaters. Rich is especially interested in gateway stations willing to participate in school interchanges via satellite. If you have a gateway station and wish to participate, please call or write to Rich Ensign. You can reach him by phone at (313) 274-1718 or by mail at 421 N. Military Dr., Dearborn MI 48124. Those who wish a copy of the compiled list should send Rich an SASE. Both Mode B and Mode L Gateway stations are being sought. Gateways in all countries are welcomed and encouraged to participate.

Glasnost' Revisited

Leonid Labutin UA3CR may be the first Soviet in many years to get a United States amateur license. On Sunday, the day after the AMSAT 1988 Space Symposium, Leo became W4/UA3CR. He passed the United States Amateur Extra-Class exam given to him by Volunteer Examiners at Georgia Tech. Leo mentioned that his biggest problem was understanding all of the FCC regulations, but, after studying the night before, he had no problem passing all of the exam elements from Novice to Extra-Class.

Dayscholar

The Dayton Amateur Radio Association is now accepting applications for its Scholarship Program. The program is open to any licensed amateur graduating from high school in 1989. Awards will be based on a combination of financial need and academic accomplishment. Consideration will be given for service to amateur radio and for community involvement.

There are no restrictions on the student's course of study, and applicants are not restricted to those preparing to pursue four-year Baccalaureate degrees. Those working toward Associate degrees or planning to attend an accredited technical institution will also be given consideration.

Each winner will receive an award of $1000 toward their tuition at the school of their choice. Entries must be postmarked before May 15, 1989. Winners will be announced on or about June 1st.

For further information or applications, write to the Dayton Scholarship Committee, 317 Ernst Avenue, Dayton OH 45401.

Thanks

. . . to all those who contributed news items to this month's QRX column. They are: *Westlink*, UB5UN, AMSAT-NA, Associated Press, WD9HXH, ARRL. Keep sending your news items into 73 Magazine, WGE Center, 70 Rte 202 N, Peterborough, NH 03458-1194.

Double Trouble! Seated are Joanne Gustafson KB9BMD (forward) and Jennifer Gustafson KB9BHR, both of Orion, Illinois. These 16-year-old twins are seated at the station of their grandparents, Leslie Conrad NO9X and Mary Conrad KA9WAG. Their Elmer was Bob Ward KØSZV.

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Simple and Easy.

Here's the easiest packet radio yet, you don't even have to buy a TNC to join the digital revolution. Just let your PC do the work. Plug a PC Packet Adapter into any expansion slot and get on the air in minutes, just like an expert. And you'll still be able to use the PC for other work! The complete VHF system is only $139.95!

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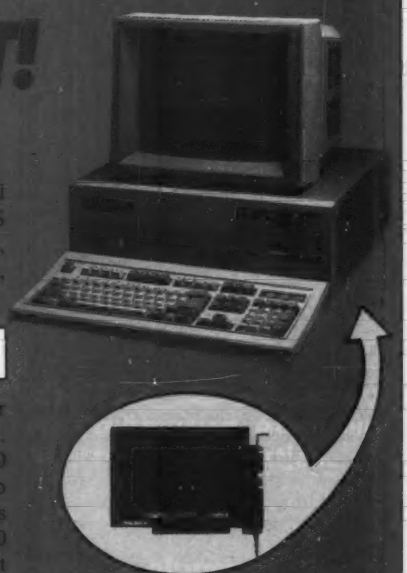

DRSI

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ORDERS: 1-800-999-0204

CIRCLE 239 ON READER SERVICE CARD

73 Review

by Brian Lloyd WB6RQN

Kenwood TS-940S

A top-flight HF rig.

Kenwood USA Corp.
PO Box 22745
Long Beach, CA 90801-5745
(213) 639-4200
Price Class: $2270 w/o tuner
$2500 w/tuner

The Kenwood TS-940S.

A Substantial Impression

The TS-940S is a full-featured HF transceiver that provides AM/FM/FSK/SSB/CW operation for all amateur bands from 160 to 10 meters. General receiver coverage ranges from 30 kHz to 30 MHz, with all-mode transmitter operation on all HF amateur bands. The radio is completely standard with no options other than the built-in automatic antenna tuner.

My immediate impression, as I placed the radio in operating position, was "This radio is substantial!" If mass is any indication, this is one robust piece of gear. Unless you are Arnold Schwartzenegger, you are not likely to consider this to be a portable rig. On the other hand, you are likely to believe Kenwood's claim that this radio has a 100% duty cycle for continuous carrier modes like RTTY and SSTV.

There is another reason why you will not run this rig in portable operation. The PA runs on 28 volts. This reduces collector current and results in a more linear and efficient PA. Unfortunately, it also makes the radio a bit difficult to power from your average 12 volt automotive electrical system. Plan to have a 120/240 volt AC power supply on hand when using this radio.

First Evaluation

My first evaluation was for ease-of-use. I set up the transceiver and deliberately ignored the manual. I wanted to see how intuitive the operation of the TS-940 really is. Although the panel is more complex than what I am used to (my last rig was a Collins KWM-2 which I regret having sold), it seems well laid out. The functions of most of the controls are obvious. As a result, I was able to have the receiver operating within a few seconds of turning it on. Unfortunately, Kenwood does not supply a microphone, so I could not get on the air immediately.

At the Controls

None of the switches or dials are "overloaded," i.e., none have more than one function per control, with the exception of the band select/data entry/memory select keys (more on this later). The controls are well-placed with room for your fingers and sufficient spacing between controls to prevent you from accidentally activating two controls simultaneously. Everything is immediately accessible, including the infrequently used controls beneath the sliding metal panel on the top of the rig.

To select operating mode, you press the appropriate mode button to the left of the main tuning knob. The radio then sends the character associated with the new mode to you in Morse code, e.g., "L" for lower sideband, "U" for upper sideband, "A" for AM, "C" for CW, "F" for FM, and "R" for RTTY. The audible feedback is nice if, like me, you like to occasionally operate late at night with most of the lights turned out.

Operating frequency can be selected in one of two ways: you can grab the main tuning knob and turn until you have reached the desired frequency, or you can press the ENTER button and key the desired frequency directly. To speed frequency selection using the main tuning knob, you can either use the MHz UP/DOWN buttons to get within 500 kHz of the frequency, or you can press one of the band selection buttons to place you within one of the ham bands from 160 meters to 10 meters. All WARC bands are represented and the transceiver will transmit on all of them. I tried transmitting outside of the ham bands (into a dummy load, of course) without success.

The tuning rate is a function of the operating mode. SSB, CW, and FSK use a tuning rate of 10 Hz/step. The tuning rate for AM and FM is 100 Hz/step. This can be a bit cumbersome since there is no way to increase the tuning rate of the main tuning dial. If you wish to move rapidly from one end of a band to the other you must either enter the frequency directly or you must turn the main tuning dial many times.

Memory and Display Features

The keypad for direct frequency entry is used for memory selection, frequency selection, and band selection. It is unlike either a telephone or a calculator keypad, so you have to think about what you are doing. Using it takes some getting used to.

The TS-940S has 40 memories, but only 10 may be accessed from the front panel at any one time.

Another "feature" of the memory capability is the inability to tune the memory once it has been selected. You have two options: use the receiver incremental tune (RIT) or copy the frequency from the memory to one of the VFOs. I found both approaches to be quite satisfactory.

The frequency display itself is quite clear and will display frequency with 10 Hz resolution (you can switch it to 100 Hz display resolution if you wish). The display always shows the carrier frequency for the appropriate mode. I was especially pleased that the space frequency is displayed when operating in RTTY (FSK) mode. There is no need to add or subtract the frequency of the modulating tones from the carrier frequency to determine the actual transmission frequency.

Across the bottom of the frequency display is an analog-like slide-rule display. When moving rapidly across the band, this display can give you an idea of where to stop. A switch on the top panel lets you select a range of 100 kHz or 1 MHz for this display. If you find digital displays to be annoying (I do for everything

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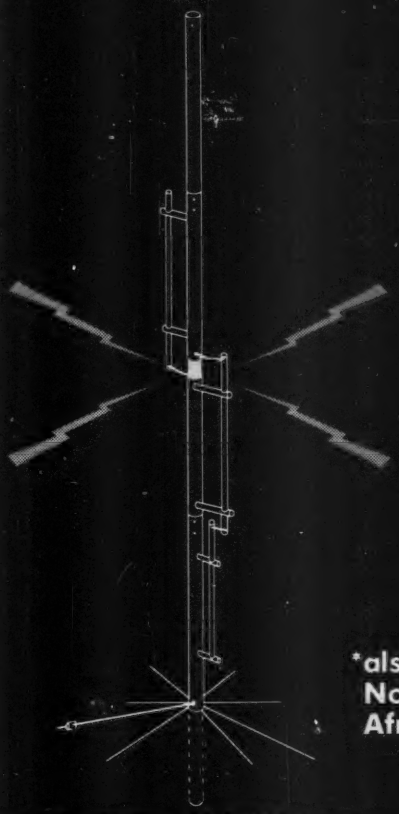

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BUT frequency) this may be an attractive feature.

Most Important Part of the Rig

Next, I examined the receiver. I consider the receiver to be the most important part of any rig, so I was especially interested in seeing how well this one would perform. You are allowed to select two different time constants for the AGC, fast and slow, or you can disable the AGC entirely and control gain by using the RF gain control. The AGC is very effective and "flat." There is almost no need to change the audio gain control even when you move from a very weak to a very strong signal. There is a four-position attenuator providing 0–30 dB of attenuation in 10 dB steps. At no time did I find the attenuator necessary to prevent front-end overload.

There are two fully adjustable noise blankers in the TS-940S. One seems to work very well for the over-the-horizon backscatter radar (woodpecker) and the other seems to work best on short duration pulse noise (ignition noise). Just turn on the appropriate noise blanker, then slowly increase the blanker level until the QRN disappears. There does seem to be a slight interaction between the noise blanker and nearby strong signals, but judicious use of the blanker level seems to keep this problem to a minimum.

Perhaps the most important feature of the receiver is its continuously variable IF bandwidth. In SSB mode, the lower and upper filter skirts are independently movable, providing "low-cut" and "high-cut" operation. In CW and RTTY mode, there is a single knob to vary the width of the passband. In CW you can also vary the BFO injection frequency, thus allowing you to pick your favorite CW note while still keeping the signal in the center of the IF passband.

On the surface this selectivity scheme seems just about ideal. In some cases it can be useful in reducing adjacent channel QRM. But, I don't think that the skirts of the standard filters are sufficiently steep to make this really useful. As you move away from full bandwidth, you don't have the second and third IF filters working in unison. The resulting roll-off at the edge of the passband is not as sharp as I would like. On the other hand, it does work and it is far more flexible than almost any other rig that I have used. I think that the optional filters would improve things considerably.

In order to help you visualize the passband, Kenwood has provided a multi-function liquid-crystal display that serves to display memory frequency content, time, and IF bandwidth. The display shows a single vertical line that represents the center of the passband. Below this line is a bar that shrinks as you reduce the width of the passband in CW or RTTY mode, or shrinks from the left or right when you use the low-cut or high-cut controls with SSB. This display is quite useful for showing memory content or time, but as a tool for setting up the receiver's passband it is almost useless. The problem is twofold: there is no calibration, so you have no idea what the width really is; and there is no indication of where the BFO injection is, relative to the passband. I found the markings on the knobs and my own ear to be just as useful in determining bandwidth. Maybe future versions of the TS-940 will have a more useful presentation.

CW, FSK, and RTTY on the TS-940S

In SSB operation I found the receiver to be a good performer, although I don't think that it is significantly better than other rigs that I have used. Where this rig shines is in working CW. You can really pull out the weak ones. Here is the technique I used:

Tune in a signal and get it approximately in the center of the passband. Use the notch filter to eliminate any especially offensive signal. Begin reducing the bandwidth while carefully tuning to keep the signal in the center of the passband. Last, use the tunable audio bandpass filter to peak the desired signal.

Using this technique I was able to isolate almost any signal. It makes copying even very weak signals a breeze. With the quality of the receiver and the full break-in (QSK) transmitter, I can easily see this rig becoming the CW contesters' favorite.

Using the TS-940S for copying RTTY, I was again quite impressed. The CW bandwidth control is operational for RTTY, allowing the operator to adjust the bandwidth to pass the desired signal, but to reject QRM regardless of the shift being used by the sending station.

There is one minor drawback with the FSK mode of operation on the TS-940S. The pitch control does not function. It would be nice if the pitch of the two tones could be varied so that a wide range of modems or terminal units could be used. In some cases the modem or TU can be adjusted to accommodate the radio so that the lack of a pitch control when operating RTTY or packet is not a big problem. Still, it is a feature that could have been added with very little trouble since the control is already there. Perhaps Kenwood will come out with a modification that will allow this.

Testing and Transmitting

I did not do any testing of the rig with test equipment, but I did want to get a subjective impression of the phase noise on this rig compared to some other radios. Compared to a non-synthesized radio (a Collins KWM-2), the phase noise is evident but not overly objectionable. When I compared the TS-940S to a top-of-the-line rig from another manufacturer, I found the phase noise to be about the same.

The transmitter of the TS-940S is quite nice. Its 250 Watt PEP output is only 7 dB, or about one S-unit, down from the legal limit. I can't imagine too many people needing or wanting to run an outboard amplifier. If you need more "punch," you can turn on the fully adjustable speech processor.

The manual claims that the speech processor operates at RF to decrease the difference between peak and average levels as much as possible. In my on-the-air tests, it raised the average signal level considerably. Setting the speech processor levels too high can result in a signal that is offensive to some. Use it sparingly and only when you really need it.

Super Antenna Tuner

One of the best features of this transmitter is the optional automatic antenna tuner. Using this tuner is quite easy: select the operating frequency, press the AT.T button, and key the transmitter. The tuner will tune out any mismatch and inform you of the results on the LCD display. When the radio informed me that it had successfully matched the antenna, I was able to secure full power output. I can imagine getting into the habit of retuning the tuner whenever the band or antenna is changed to protect the PA from inadvertent damage. As far as I am concerned, this feature is an absolute must.

I was quite surprised at the range of the tuner. I tried several different commercial antennas and a random wire. The tuner was able to cope with all of the commercial antennas without any problems. The tuner did have difficulty with some lengths of random wire on some frequencies, but slightly changing the length of the wire solved that problem. If the tuner was unable to come up with an acceptable match, and this situation occurred very infrequently, the message "No match possible" appeared in the LCD display.

While on the air I got nothing but good reports from everyone I talked to. On CW no one could detect chirp, click, or other bad characteristics. I became addicted to the full break-in (QSK) operation. I did use the speech processor once or twice and everyone I talked to seemed to think that it added about 4 to 5 dB more punch to the signal. No complaints about this rig for CW or SSB operation.

Packet on the TS-940S?

I was hoping to use the FSK mode but, unfortunately, it cannot be used with packet because the FSK shift is not adjustable. Packet uses a 200 Hz shift. The TS-940S is synthesized at 170 Hz (actually a 165.9 Hz shift), but is strappable for 170, 425, or 850 Hz shifts internally. This is not documented in the manual, but it does appear in the schematic for the PLL unit.

There is no way to select the BFO injection frequency, either. Changing the BFO injection frequency would permit the operator to change the audio tones coming out of the receiver to allow compatibility with different modems (RTTY typically uses 2125 and 2295 Hz tones while packet uses 1600 and 1800 Hz tones). I was forced to fall back on the old standby of selecting LSB operation and using AFSK. Still, the continuously variable passband makes packet reception pretty reliable. You just have to do a little more work to figure out the operating frequency.

In Sum

Now we're down to the bottom line: this is a first-class radio. If you are into HF packet radio, you might be disappointed about not being able to make use of the RTTY mode of operation. It does, however, do what it was designed to do, and it does that very well. If you are looking for good performance, and you can ignore the slight ergonomic deficiencies, then this rig is for you. Thanks for a good effort, Kenwood. 73

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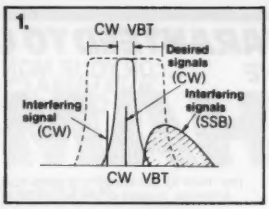

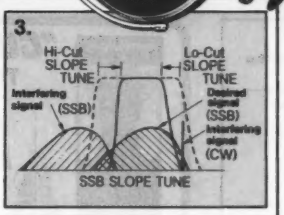

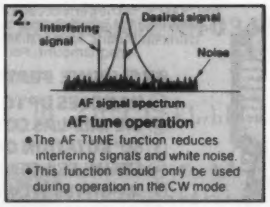
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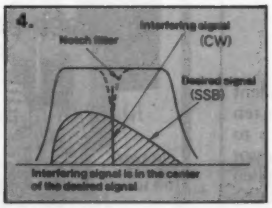

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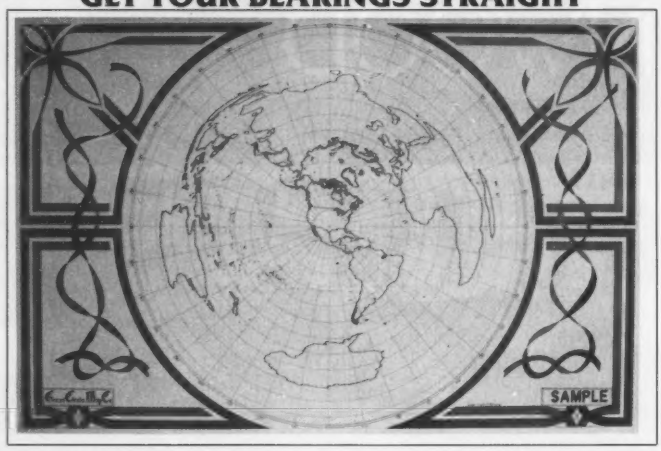

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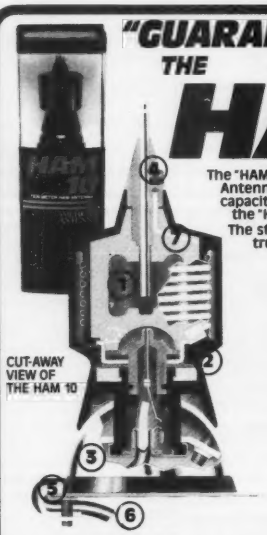

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9	Home-brew: One-Stage 80 Meter CW Transmitter
10	Review: Ham-10 Antenna
11	Review: Magnus Mobile Amplifier
12	Review: Pro-67 HF Antenna
13	Home-brew: TCM 3105 Modem for the Digicom>64
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ICOM America, Inc.
2380-116th Ave. NE
Bellevue, WA 98004
Price Class: $6000

Last year I reviewed the ICOM 761 and stated that it was "the most precise and complete ham transceiver from ICOM to date." And it was, once upon a time; but now, the ICOM 781 is ICOM's latest and most complex HF transceiver. It is fully solid state and CPU-based. The mere term "transceiver" doesn't do it justice. The IC-781 incorporates features that used to require a desktop full of extra equipment.

The IC-781 combines a CRT display of functions, frequencies, memories, and spectrum scope with a top-notch transceiver, automatic antenna tuner, and AC power supply, into the most complete one-piece HF ham station available today.

The IC-781's Operating Manual

The first mark of the IC-781's high class is its operating manual. It is absolutely thorough—it has nearly 100 pages of instructions, photos, diagrams, and charts. The manual comes in a zippered, heavy-duty plastic bag, the kind meant for re-use, along with the radio's inspection certificate and warranty cards.

After unpacking the radio and placing it on my operating desk, I studied it for a few minutes. I counted 112 separate controls on the front panel, and decided that it would be greatly advisable to read the instruction manual before plugging it in.

Overview of Features

The built-in spectrum scope displays the relative signal strength of radio transmissions up and down the band from your frequency. The band width is selectable between 50, 100, and 200 kHz. It is not a true scope, but a well-engineered computer facsimile.

The Terminal Monitor allows you to use the CRT for digital display of RTTY, packet, etc., and the built-in Automatic Antenna Tuner is for hands-off adjustment of antenna matching (limited to 16.7–150Ω, or at less than 3:1SWR). The Direct Digital Synthesizer provides extremely fast "lock-up" times for transmit/receive switching.

Dual Watch lets you monitor two separate frequencies simultaneously, while Fine Scanning tunes slowly through a received signal without stopping. This feature is particularly valuable for CW and SSB. Twin Passband Tuning controls tandemly, or separately, the tuning of the 455 kHz and 9 MHz IFs.

The AGC is fully adjustable. During CW operation, the Audio Peak Filter attenuates unwanted audio components between 500 and 1000 Hz.

Other features are: full break-in keying, 150 Watt output, noise blanker, 105 dB dynamic range, and a multi-function keyboard for digital (fingertip) entry of frequencies. The memory channel holds 99 memories, including two-band scan entries. You can display these memories, together with a label, on the CRT. Examples of labels are net names or operator notes. The IC-781 has two clocks for local and UTC time settings, and timers for turning the transceiver on and off as predetermined.

This review is made from an operator's point of view; it is not the result of strenuous laboratory testing.

Operator Viewpoint

The IC-781 is quality all the way. The controls feel solid, everything works as expected, and the manual explains all you need to know, in both words and diagrams.

The tuning knob is large and has a fairly smooth action. It tunes at the rate of 5 kHz or 2.5 kHz per revolution, as selected by an internal switch. The knob is not as large or as smooth in operation as the IC-761's. The main tuning knob has a tension adjustment under the front of the radio.

The frequency read-out has the 10 Hz digit. I find this feature nice, although some operators feel that it makes tuning too critical. This is a matter of choice. You can calibrate frequency without entering the case.

Many of the seldom-used controls, such as VOX, lighting, etc., are pull-out types. The clocks and memories have battery backup. Should the batteries fail, the radio will continue to operate, without memories or clocks.

In general, the IC-781 performs as you would expect a top-of-the-line radio to perform. After learning how to use the many controls, I found it was possible to clean up signals unreadable on older types of radios. For example, signals in the QRM on a TR-4 became completely readable on the IC-781.

The speech processing gave an extra punch to the signal that reached out well, yet it did not foul up the intelligibility of the transmission. On a scope, the voice patterns filled in well when I used the processor.

The spectral display of the band revealed the location of the loud stations, and also indicated open places in the band. It afforded a quick look at a band for activity.

Being able to scroll the memory list on the CRT and to enter the frequency and mode with a single keystroke are great features of the IC-781. When dealing with 99 memories, I found the label field very important. It allows you to name a memory (i.e., MIDCARS, VA FONE NET, GULF COAST, etc.) and easily access it.

The IC-781 Receiver

The receiver is very quiet, with little background white noise. With fully variable parameters, it can reduce or eliminate most QRM/N. The twin passband tuning is especially effective in cutting out QRM from adjacent signals. Forty meter evening operation is relatively easy with the twin passband tuning, notch, and attenuators. The notch filter is easily tuned and effectively deep. However, considering the price of this rig, why isn't it automatic?

For more variables, you can use the receive preamp or the attenuators. You can choose 10 and 20 dB for the latter, or switch both on for 30 dB of attenuation.

The quality of the receive audio from the built-in speaker is excellent, coming in a close second to my main station speaker. The BASS/TREBLE controls improve the built-in speaker's sound quality.

The IC-781 has several methods of scanning. It does memory scan, programmed scan, and mode scan. To use mode scan, you must first go into memory mode. There, mode scan will find channels of only a given mode, e.g. LSB or FM.

Dual watch is nice when you're monitoring a specific frequency for activity. It does, however, have the drawback of being limited to the same band as other operations. There is no crossband dual watch.

The passband tuning arrangement looks like it would be great on RTTY and packet, although I didn't test this possibility.

The Transmitter

The two VFOs make split operation available at the push of a button. The IC-781 can also be easily modified for CAP and MARS frequencies.

ICOM 781 Specifications

General

Frequency Coverage:	
Receive:	0.1 MHz to 30.0 MHz
Transmit:	1.8–2.0 3.4–4.1 6.9–7.5 9.9–10.5 13.9–14.5 17.9–18.5 20.9–21.5 24.4–25.1 27.9–30.0
Modes:	SSB (A3J)/CW (A1)/FM (F3)/RTTY (F1)/AM (A3)
Frequency step:	10 Hz (TS off)/1 kHz (TS on) Antenna impedance:50Ω unbalanced (tuner off)
Power requirements:	100–120 VAC (US version) 220–240 VAC (others)
Usable temperature range:	−10 to +60°C
Frequency Stability:	+/−15 Hz (full temperature range)
Dimensions:	425 mm x 149 mm x 411 mm (WHD) w/o projections: 16.5 in x 5.8 in x 16.0 in
Weight:	23 kg 50.6 lbs.

Receiver

Conversion System:	SSB, CW, RTTY, AM quadruple conversion FM triple conversion

IF Frequencies (in MHz):

	SSB	CW/RTTY	AM	FM
1st	46.5115	46.5106	46.5100	46.5100
2nd	9.0115	9.0106	9.0100	9.0100
3rd	0.4550	0.4550	0.4550	0.4550
4th	10.6950	10.6950	10.6950	n/a

Sensitivity (preamp on):	SSB/CW/RTTY for 10 dB S/N 0.1–0.5 MHz: less than 0.5 microvolt 1.8–30.0 MHz: less than 0.16 microvolt AM for 10 dB S/N 0.1–0.5 MHz: less than 3.2 microvolts 0.5–1.8 MHz: less than 6.3 microvolts 1.8–30 MHz: less than 1.0 microvolt FM for 12 dB SINAD 28–30 MHz: less than 0.23 microvolt
Squelch Sensitivity:	less than 0.23 microvolt
Selectivity:	SSB, CW wide, RTTY wide, AM narrow more than 2.4 kHz/−6 dB less than 3.8 kHz/−60 dB CW narrow, RTTY narrow (with CW250 Hz off) more than 500 Hz/−6 dB less than 1 kHz/−60 dB CW narrow, RTTY narrow (with CW 250 Hz on) more than 250 Hz/−6 dB less than 800 Hz/−60 dB AM wide more than 6 kHz/−6 dB less than 15 kHz/−60 dB FM more than 15 kHz/−6 dB less than 30 kHz/−50 dB
Spurious and Image Rejection Ratio:	
Image:	less than −60 dB
IF:	less than −70 dB
Audio Output:	greater than 2.6 W at 10% distortion (8Ω load)
Notch filter attenuation:	greater than 45 dB
RIT Range:	+/−9.99 kHz

Transmitter

Maximum Output Power (Watts)	SSB (PEP)	150
	AM	75
	CW	150
	RTTY	150
	FM	150

Modulation:	
SSB:	balanced modulation
FM/RTTY:	reactance modulation
AM:	low-level modulation
FM Deviation:	+/−5 kHz
RTTY Shift:	170, 425 & 850 Hz selectable
Spurious Emissions:	less than −60 dB
Carrier Suppression:	less than −40 dB
Unwanted Sideband Suppression:	less than −55 dB
Microphone Impedance:	600Ω

Antenna Tuner

Output Matching Range:	16.7 to 150Ω unbalanced feedline
Minimum Input Power:	15 Watts
Band Switching Time:	less than 3 seconds
Auto Tuning Time:	less than 3 seconds
Auto Tuning Accuracy:	VSWR less than 1.2:1
Insertion Loss:	less than 0.5 dB (after tuning)

CRT Display

Output level	
Composite video signal:	1 V p-p
Video components:	0.7 p-p positive
Synchronous components:	0.3 p-p negative
Output impedance:	75Ω
Usable humidity range:	10–90% (keep from moist environments)
Horizontal frequency:	15.75 kHz
Vertical frequency:	60 Hz

The keyer behaved wonderfully, offering full break-in and semi-break-in operations. There is, unfortunately, only an internal adjustment for dit-dah ratios.

The monitor feature allows you to hear your SSB audio component, making it easy to adjust the speech processor, and the microphone's tone and drive, as well as letting you hear other imperfections on your signal. The audio and CW signal reports I received were all good.

The built-in antenna tuner is fast, and it will handle most cleanup jobs caused by excursions within a band. It will not tune "Grandma's bedsprings." It can handle SWR mismatches only to 3:1.

The circuit used to key linear amplifiers is stout enough only for modern 12 volt circuits. To use it on anything else could cause damage. I recommend using an external relay. The IC-781 is not alone in this deficiency; most other makes and models suffer from a similar shortcoming.

Bench Testing

Bench testing is the only true method of measuring the performance of a transceiver. Personally, I feel that all of the currently available CPU-based HF transceivers are capable of performing above and beyond the capabilities of the human ear, and certainly over the poor band conditions that we all too often experience. The IC-781 is no exception to the rule.

I used the following lab equipment to check the performance of the IC-781:

- Leader LDC 8243 Frequency Counter
- Marconi Instruments 2022 Signal Generator
- Hewlett Packard 606 HF Signal Generator
- Hewlett Packard 651A Audio Generator
- Bird 43 Wattmeter
- Hewlett Packard 8551B/851B Spectrum Analyzer
- Cushman CE-5 Monitor
- Tectronics 475 Oscilloscope

Any Complaints?

There is little fault to find with the IC-781. It is a well-designed unit, built with the operator in mind. There were a few things, however, I didn't care for.

The digital key pad is important for operating dexterity, and allows you to enter a frequency without turning the main tuning knob. I was, however, surprised to discover that when I entered a frequency directly, the digital key pad mode did not automatically change. For example, 7.255 MHz is on LSB, but when you've made that selection from a previous setting of 14.313 MHz (USB), the USB mode will follow. In other words, there is no bandplan programmed into the unit.

Second, I don't care for the dot-type presentation of the surrounding spectrum on the display. A real scope trace is easier to read.

Third, even though the IC-781's overall appearance is truly a "ten," after setting it up, I noticed that I had a problem reading the control labels, which are medium gray on a nearly black background. A few are red, but none are easily seen in typical lighting. The white lettering on my 735, 751A, and 140, is easily readable.

Not all operators will use every feature of the IC-781, and to some the unit would be unacceptable due to its complexity. To others the price might be extravagant. However, feature for feature, the IC-781 is the most capable piece of HF equipment currently available. I feel comfortable recommending the IC-781 as a true state-of-the-art, unique piece of equipment.

Where Do the Dollars Go?

I've heard some interesting comments about the IC-781. Among them are: It costs more than my first house. My pickup truck cost less than the IC-781. Who is going to fix it when it breaks? If I take that home, I'll be getting a divorce. It doesn't do that much more than a $2,000 radio. It's so heavy, it would crush my desk.

Most of the comments are about the IC-781's cool list price of $5,995. That ain't hay, my friend. However, let's put these numbers into perspective. In 1958, you could buy a Collins 32S1, 75S1, and the goodies to go with it, for about $1,590. That was in the day of the $15,000 house and $2,500 automobile. Today the home will cost nearly $100,000 (depending upon geographical location) and the family chariot about $15,000. Perhaps these numbers place the high price of the IC-781 more in line with today's economy.

I have included a chart of the manufacturer's specifications to show how the various top dollar rigs compare. The IC-735 is included on the chart just to put some depth into the study of cost vs. what you get.

"Thank you" to the folks at the Electronic Equipment Bank of Vienna, Virginia, for the loan of an IC-781, and the use of their very complete test bench.

Comparative Specifications Chart for HF Transceivers

Make/Model	ICOM 781	Kenwood TS-940	ICOM 761	Ten-Tec Paragon	Yaesu 767	ICOM 735
Dimensions(hwd)	8x16.7x16	5.5x15.8x13.8	5.9x16.7x15.3	5.8x14.8x17	5.2x14.5x11.5	4x9.5x9.4
Weight	50.6	40.8 lbs	38.6	16 lbs	30 lbs	11 lbs
Display	flourescent	flourscent	flourscent	flourescent	flourescent	LCD
Freq. stability	±15 Hz	±100 Hz	100 Hz	±30 Hz	30 Hz	±30 Hz
Internal AC power	yes	yes	yes	no	yes	no
Transmitter						
RF input		250 watts		200 watts		200 watts
output	150 watts		100 watts	100 watts	100 watts	
adjustable	yes	yes	yes	yes	yes	yes
Harmonic supp.					50 dB	40 dB
Spurious supp.	60 dB	40 dB	60 dB	45 dB		50 dB
Carrier supp.	40 dB	40 dB	40 dB	60 dB	40 dB	40 dB
Unwanted sideband	55 dB	50 dB	55 dB	60 dB	50 dB	50 dB
Microphone	600 ohms	500-50K ohms	600 ohms	Hi/Lo	500-600 ohms	600 ohm
Receiver						
Receiver IFs	four	four	four	three	three	three
1st IF	46 MHz	45 Mhz	70 MHz	75 MHz	45 MHz	70 MHz
2nd IF	9 MHz	8.8 Mhz	9 MHz	9 Mhz	8.2 MHz	9 MHz
3rd IF	455 kHz	455 kHz	455 kHz	6.3 MHz	455 kHz	455 kHz
4th IF	9 MHz	100 kHz	9 MHz			
Sensitivity (HF)	.16 micro volt	.2 micro volt	.15 micro volt	.15 micro volt	.25 micro volt	.15 micro volt
Selectivity						
SSB/CW	2.4 kHz/- 6dB 3.8 kHz/-60dB	2.4 kHz/- 6dB 3.6 kHz/-60dB	2.4 kHz/- 6dB 3.8 kHz/-60dB	2.4 kHz/- 6dB 3.4 kHz/-60dB	2.7 kHz/- 6dB 4.5 kHz/-60dB	2.3 kHz/- 6dB 4.0 kHz/-60dB
Dynamic range	105 dB	102 dB	105 dB	100 dB		105 dB
Spurious rej	70 dB		80 dB			80 dB
Image ratio	80 dB	80 dB				
Image rej		70 dB	80 dB	80 dB	70 dB	80 dB
Notch att	45 dB	40 dB	45 dB	50 dB	30 dB	30 dB
Audio output	2.6 watts	1.5 watts	2.6 watts	1.5 watts	1.5 watts	3 watts
Memories	99	40	32	62	10	12
PBT	yes	yes	yes	yes	no	yes
IF shift	yes	no	yes	no	yes	no
Dual VFOs	yes	yes	yes	yes	yes	yes
RIT	yes	yes	yes	yes	no	yes
AGC selectable	yes	yes (2 + off)	yes	on/off	yes (3 + off)	yes
Split operation	yes	yes	yes	yes	yes	yes
Speech proc	yes	yes	yes	yes	yes	yes
Noise blanker	yes	yes (2)	yes	yes	yes	yes (2)
Internal ant tuner	yes	option	yes	no	yes	optional
Freq keyboard	yes	yes	yes	yes	yes	no
FM	yes	yes	yes	option	yes	yes
Keyer	yes	no	yes	no	yes	optional
Opt filters	yes	yes	yes	yes	no	yes
Rec-preamp	yes	no	yes	no	yes	yes
Rec-att	yes	yes	yes	yes	yes	yes
List price	$5,995.00	$2449.95	$2699.00	$2245.00	$1929.95	$1099.00
Remarks	CRT display of parameters & spectrum	scope option clock/timer 10 Hz readout variable bandwidth tuning Hi-Lo cut PBT	audio monitor best tuning knob feel	10 Hz readout labeled memories Made in USA	VHF/UHF options built-in 600 Hz filter CAT system	very small size optional external automatic antenna tuner

specifications above are as listed on manufacturers advertising/sales literature

Comparative specifications chart for HF transceivers. This chart was complied by the author and produced on his PC-DOS compatible and Ashton Tate's Byline™ desktop publishing software.

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

KIT, ONLY $675

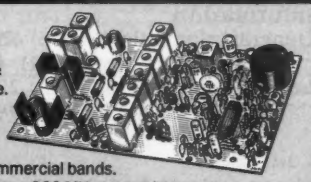
WIRED $975

VHF OR UHF

FEATURES:

- **SENSITIVITY SECOND TO NONE!** **GaAsFET front end** on vhf models gives 12dB SINAD of 0.12uV (vhf), 0.15uV (220). UHF model 0.25uV std, 0.1uV with optional helical resonator preamp.
- **SELECTIVITY THAT CAN'T BE BEAT!** Both 8-pole xtal filter & ceramic filter for **>100dB at only ±12kHz.** Helical resonator front end to combat desense & intermod.
- **CLEAN, STABLE TRANSMITTER,** up to 18W output standard; 50W with accessory power amplifier.
- **FCC TYPE ACCEPTED** for commercial high band and uhf.
- **Courtesy beep,** field-programmable CWID, flutter-proof squelch, automatic frequency control to compensate for off-frequency transmitters (all standard features).
- **Full range of options** available, such as autopatch, phone line or radio remote control, sub-audible tones, duplexers.

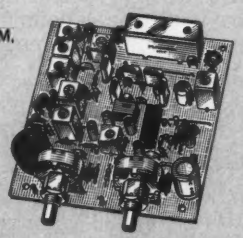
HIGH PERFORMANCE TRANSMITTERS & RECEIVERS FOR REPEATERS AUDIO & DIGITAL LINKS, TELEMETRY, ETC.



- **FM EXCITERS:** Kits $99, W/t $179. 2W continuous duty. TCXO & xtal oven options available.
- **TA51 for 10M, 6M, 2M, 150-174, 220 MHz.**
- **TA451 for uhf.**

FCC type accepted for commercial bands.

- Call for latest information on 900 MHz transmitters.
- **VHF & UHF AMPLIFIERS.** For FM, SSB, ATV. Output from 10 to 50 Watts. Several models, kits starting at $79.



- **R144/R220 FM RECEIVERS** for 2M, 150-174, or 220 MHz. **GaAs FET** front end, 0.12uV sensitivity! Both crystal & ceramic filters plus helical resonator front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere)! Flutter-proof squelch. AFC tracks drifting transmitters. Kit $149, w/t $229.
- **R451 UHF FM RCVR.** Similar to above. Tuned line front end, 0.25uV sens. (0.1uV with optional hel. res. preamp). Kit $149, w/t $229.
- **R901 FM RCVR FOR 900 MHZ.** Triple-conversion, GaAs FET front end, 0.2uV sens. Kit $169, w/t $259.
- **R76 ECONOMY VHF FM RCVR** for 10M, 6M, 2M, 220. Without hel res or afc. Kits only $129.
- **Weather satellite & AM Aircraft receivers also avail.**

FCC TYPE-ACCEPTED TRANSMITTERS & RECEIVERS AVAILABLE FOR HIGH-BAND AND UHF. CALL FOR DETAILS.

GaAs FET PREAMPS

at a fraction of the cost of comparable units!

LNG -(*)

GaAs FET PREAMP

ONLY $59! Wired/tested

FEATURES:

- **Very Low Noise:** 0.7dB VHF, 0.8dB UHF
- **High Gain:** 13-20dB, depending on frequency
- **Wide Dynamic Range:** to resist overload
- **Stable:** new-type dual-gate GaAs FET

** Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.*

LNW -(*)

MINIATURE GaAs FET PREAMP

ONLY $24/kit, $39 Wired/tested

GaAs FET Preamp similar to LNG, except designed for **low cost & small size.** Only 5/8"W x 1-5/8"L x 3/4"H. Easily mounts in many radios.

** Specify tuning range desired: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.*

LNS-(*)

IN-LINE PREAMP

ONLY $79/kit, $99 Wired/tested

GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit.** Use with base or mobile transceivers up to 25W.

**Specify tuning range desired: 120-175, 200-240, or 400-500 MHz.*

HELICAL RESONATOR PREAMPS

Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

MODEL HRA-(*), $49 vhf, $84 uhf.

** Specify tuning range desired: 143-150, 150-158, 158-162, 162-174, 213-233, 420-450, 450-465, or 465-475 MHz.*

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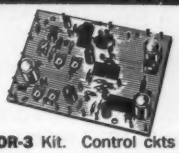
You've waited a long time for a simple, reliable, **low-cost 9600 baud PACKET NETWORKING system.** Now you've got it! Our new MO-96 MODEM and direct FSK Transmitters and Receivers for 220 or 440 MHz interface directly with most TNC's. Fast diode switched PA's output 15 or 50W. **Call for complete info on the right system for your application.**

ACCESSORIES



- **COR-3** Kit. Control ckts and audio mixers needed to make a repeater. Tail & time-out timers, local spkr ampl, courtesy beep $49
- **CWID** Kit. Field programmable, timers, the works $59
- **TD-2 DTMF DECODER/ CONTROLLER** Kit. Full 16 digits, switches 5 functions, toll call restrictor, programmable, much more. Great for selective calling too! $79
- **AP-3 AUTOPATCH** Kit. Use with above for repeater autopatch. Reverse patch and phone line remote control std. $79
- **AP-2 SIMPLEX AUTOPATCH TIMING BOARD** Kit. Use with above for simplex autopatch $39
- **MO-202 FSK DATA MODULATOR** Kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc. $39
- **DE-202 FSK DATA DEMODULATOR** Kit for rcvr end of link $39

RECEIVING CONVERTERS

		Antenna Input Range	Receiver Output
		28-32	144-148
		50-52	28-30
		50-54	144-148
VHF		136-138	28-30
MODELS		144-148	28-30
		145-147	28-30
Kit with Case	$59	146-148	28-30
Kit less Case	$39	220-222	28-30
Wired w/case	$89	220-224	50-54
		222-224	28-30
UHF MODELS		432-434	28-30
Kit with Case	$69	435-437	28-30
Kit less Case	$49	432-436	144-148
Wired w/case	$99	432-438	50-54
		439.25	61.25
		902-928	422-448
		902-922	430-450

See catalog for full line of 2w transmitting converters for vhf & uhf. Kits only $79. Linear Amplifiers avail. up to 50 w.

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DAYTON Hamvention®

April 28, 29, 30, 1989

Early Reservation Information

• General Chairman, Bill McNabb, WD8SAY

• Asst. General Chairman, Ed Hillman, N8ALN

• Giant 3 day flea market • Exhibits
• License exams • Free bus service
• CW proficiency test • Door prizes

Flea market tickets and grand banquet tickets are limited. Place your reservations early, please.

Flea Market Tickets
A maximum of 3 spaces per person (non-transferable). Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. Vendors MUST order registration ticket when ordering flea market spaces.

Special Awards
Nominations are requested for "Radio Amateur of the Year," "Special Achievement" and "Technical Achievement" awards. Contact: Hamvention Awards Chairman, Box 964, Dayton, OH 45401.

License Exams
Novice thru Extra exams scheduled Saturday and Sunday by appointment only. Send FCC form 610 (Aug. 1985 or later) - with requested elements shown at top of form, copy of present license and check for prevailing ARRL rates (payable to ARRL/VEC) to: Exam Registration, 8830 Windbluff Point, Dayton, OH 45458

1989 Deadlines
Award Nominations: March 15
Lodging: April 7
License Exams: March 26
Advance Registration and banquet:
USA - April 4 Canada - March 31
Flea Market Space:
Spaces will be allocated by the Hamvention committee from all orders recieved prior to February 1. Express Mail *NOT* be necessary! Notification of space assignment will be mailed by March 15, 1989.

Information
General Information: (513) 433-7720
or, Box 2205, Dayton, OH 45401
Lodging Information: (513) 223-2612
(No Reservations By Phone)

Lodging
Please write to **Lodging, Dayton Hamvention, Chamber Plaza, 5th & Main Streets, Dayton, OH 45402** or refer to our 1988 Hamvention program for lodging information which includes a listing of hotel/motels located in the surrounding areas of Dayton. Reservations for the surrounding area will then become the responsibility of the individual.

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

Advance Registration Form

Dayton Hamvention 1989
Reservation Deadline – USA-April 4, Canada-March 31
Flea Market Reservation Deadline: February 1

Enclose check or money order for amount indicated and send a self addressed stamped envelope.

Please Type or Print your Name and Address clearly.

	How Many		
Admission (valid all 3 days)	_____	@ $10.00*	$_____
Grand Banquet	_____	@ $20.00**	$_____
Women's Luncheon (Saturday)	_____	@ $7.00	$_____
(Sunday)	_____	@ $7.00	$_____
Flea Market (Max. 3 spaces)	_____	$25/1 space $50/2 adjacent $150/3 adjacent	$_____
Admission ticket must be ordered with flea market tickets		**Total**	$_____

* $12.00 at door ** $22.00 at door, if available

Name _____

Address _____

City _____ State _____ Zip _____

Make checks payable to – **Dayton HAMVENTION**

Mail to – **Dayton Hamvention**
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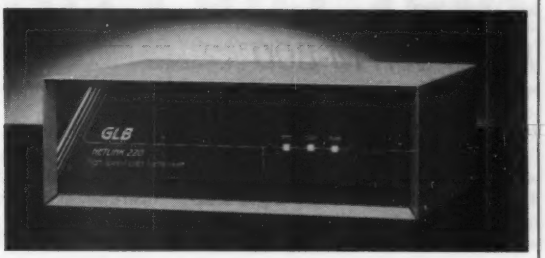

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Conservative design
Data-transparent operation
Digital sampling AFC
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High-speed squelch supplies DCD
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Complies with all applicable Sections of Part 15 FCC Rules

SPECIFICATIONS:

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Data format: any format incl NRZ and NRZI
Modulation: FSK
Signal levels: TTL or RS232C
Frequency: 220 to 225 Mhz
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Turnaround time: 1 ms TX
1 ms RX
Power output: 2 W min
Fuse: 3 Amp

Digital sensitivity: .5 uv for 1 error/K
Squelch response time: 1 ms
Spurious output: -60 dbc max
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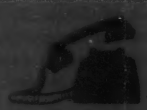

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73 Review *by Peter Ferrand WB2QLL*

Just The FAX

Info-Tech M-800

Universal Radio
1280 Aida Drive
Reynoldsburg, OH 43068
PH: (614) 866-4267
Price Class: $300

This little black box says it's a FAX converter, and if you know what that means and want to receive lots of FAX pictures, the Info-Tech M-800, manufactured by Digital Electronic Systems, is probably the best low-cost way to do the job. If you're wondering just what FAX is, or asking: "Can't I just use my computer?" or "Does it smell bad?" then it's time for an explanation. Here is a unit that does exactly what it's supposed to do. As long as that matches your requirements, it's a worthwhile investment.

Facsimile, or FAX, is a mode whereby still pictures are transmitted at resolutions of 800 or more lines per frame. In order to fit that much data into a bandwidth no larger than an audio channel, it can take from five to fifteen minutes to send one picture.

While FAX is still a little known mode within the ham community, there are many FAX transmissions available, both on shortwave and direct via satellite. The great bulk of commercial and government FAX are weather charts, plus a good assortment of press photographs from wire services worldwide.

The M-800

The M-800 is designed as a low-cost way to get those images to form on your printer simply and reliably with a minimum of fuss. While not intended as a piece of ham equipment, it is designed to duplicate most of the functions of the dedicated commercial FAX units while using an ordinary computer-type letter quality dot matrix printer.

In contrast to commercial FAX units, the M-800 will receive images from a variety of different sources using different data transmission standards. Commercial FAX systems are generally set up for one standard for a particular service, and use various and sometimes odoriferous electrochemical printing techniques that require forty to fifty cents' worth of paper per page.

FAX, also known as radiofax, is one of the many weird noises heard while tuning across the shortwave or satellite bands. Once you've figured out how to pick up a given signal emanating from a given transmitter, it only takes a few seconds to set things up again. For new stations, it's a lot like trying to pick up commercial RTTY services—there's quite a bit of trying various combinations of equipment settings before you see some intelligible output. The M-800's manual repeatedly mentions the need for patience in this sort of experimentation, so if you aren't prepared to invest some time (and printer paper!), you'd better be satisfied with picking up nothing more complex than the National Weather Service charts.

Interfacing the M-800

The M-800 is simply a small box that connects a receiver and a printer. The receiver should be high quality because drift, distortion, images, and other flaws will severely reduce the quality of the FAX image. The receiver section of any of the current general coverage synthesized sideband transceivers should suffice, although I have obtained better results by using modern commercial or military shortwave receivers because of their better front ends and lower levels of distortion.

For satellite reception, which I didn't try, the manual says you'll need to use the unfiltered baseband video output of the satellite receiver, and feed that into a general coverage receiver capable of tuning 0–13 MHz, which can receive FM. Satellite signals appear on the 135–138 MHz band, as well as on the S, C, and Ku bands.

The printer should have a parallel interface and match the control codes of either the Epson LQ-800 or the Epson FX-85/86. The LQ-800, a 24-wire printer, will produce higher quality images.

My printer is an Epson with a serial interface. This interface problem is simply (but rather expensively) solved by using a Quadram Microfazer serial-to-parallel converter. The important thing is for the printer to respond to the bit-mapped graphics that the standard Epson uses.

Setting the M-800's Controls

Other than the on-off switch and a switch to change from AM to FM demodulation, the M-800's controls consist of six momentary contact push buttons. These buttons control formatting, such as the speed of the received FAX signal, the height-to-width ratio (known as Index of Cooperation, or IOC), the direction

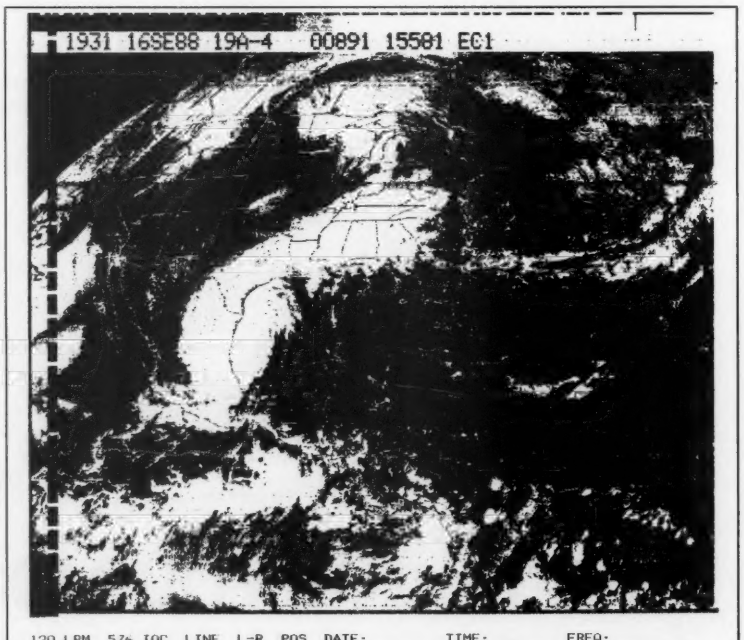

Figure 1. FAX image of a press photo. The GRAY mode is used here to give shading. This image shows the center of Hurricane Gilbert passing over Eastern Mexico.

(whether the picture is drawn from right to left or left to right), and the polarity (whether the picture should be printed as a negative or a positive).

You can adjust these controls on the fly. If you are printing out something and it doesn't look right, you can change the settings, and in two minutes or so you'll know if you are getting any closer. Some of the settings are optional; cloud patterns, for instance, are supposed to be printed as white clouds on a dark earth, but there will be less wear on the ribbon and the printer if it's printed as a negative.

The M-800 also provides a choice of LINE or GRAY mode. For hand drawn weatherfax charts, LINE provides the greatest detail and black and white contrast. The GRAY mode is used to give shading for press photos.

There is also a control for manually starting and stopping the printing operation. In the ideal case, the M-800 will pick up the start tones at the beginning of each picture from the transmitting station and start the printer by itself, then stop it when the picture is done. But sometimes you may want to start the picture yourself, such as when you happen to tune into a FAX station in the middle of a transmission. Stop signals are not completely standardized, so the converter will not always pick them up. In that case, you can stop the printer manually.

A FRAME button moves the image to the left in half-inch increments. This feature is useful because, when a picture is manually started, it is not likely to be lined up properly on the page. A group of LEDs above the buttons provide a status read-out of button settings.

The only tuning indication is an LED labeled TUNE, which lights up when the signal is properly tuned in. Since I'm used to an oscilloscope for tuning, the single LED seemed a bit spartan. I was never sure if I had actually tuned in a signal correctly. Yet the LED is sufficient because the actual tuning of FAX is not nearly as critical as RTTY, and picture quality, especially darkness and lightness, can be varied as a function of the tuning. I'd still prefer an output for a scope, though.

"The M-800 is simply a small box that connects a receiver and a printer."

Installation, Set-up, and Operation

The installation and set-up of the unit is straightforward and proceeds just as the manual indicates. The manual, though not polished in appearance, is readable, complete, and well-organized for someone with a basic knowledge of radio or shortwave listening. Someone who has played with receivers and RTTY will have no problems whatever. There are plenty of examples of properly and improperly tuned FAX pictures. The manual also includes information on getting paper and ribbons, a starter list of FAX stations to tune in, and even a schematic for those of us who feel cheated if we don't know what it is we've bought.

The M-800's internal construction and workmanship is excellent, with all chips in sockets and even an internal fuse in series with the 12 volt input.

Info-Tech products are manufactured in Fort Lauderdale, Florida, by Digital Electronic Systems, the successor firm to the original Info-Tech organization. The exclusive retail distributor for DES is Universal Shortwave Radio of Reynoldsburg, Ohio, which also deserves a good word. Not only has Universal's customer service met my every expectation, but Universal maintains a computer bulletin board known as UBIX for the exchange of information of interest to shortwave listeners, and publishes a periodical, *The RTTY Listener*, which lists frequencies and stations for shortwave listeners using all the digital modes, including FAX.

Once you are familiar with the M-800 and FAX, operation is simple. You tune in the signal, set the parameters on the M-800 front panel, and start up the printer. If a station using a standard format is being received, the M-800 will just keep printing out pictures, a new one on every page. If you choose, you can have the M-800 print out a status line at the bottom of every page listing all the parameters involved, along with spaces for you to write in, by hand, a log entry for the date, time, and frequency.

Finding new stations will generally show the results of your trial and error testing of the various possible settings—many pages will print out what can most optimistically be called "abstract art."

No Computer Necessary

Up-to-date readers will undoubtedly note that computers have not been mentioned yet. That's because the M-800 needs no additional computers hooked to it. While the M-800 can share its printer with your personal computer, there is no provision within the M-800 for any data transfer between the M-800 and a computer. The M-800 takes in audio from a receiver and puts out data formatted for a parallel printer—it does nothing more. If you are thinking of buying the M-800, take note that there's no way to control it by computer, and no simple way to save the FAX images.

The multimode demodulators, such as the PK-232 and the KAM, are computer controlled, and the images can be saved on the computer's disk. Furthermore, with these units, the images are displayed, albeit with less resolution, on the computer's video screen as they are sent. Although just as time consuming, your experiments don't use up reams of paper.

What you get with the M-800, then, is a unit that works well, with the versatility to print whatever most people want to print. For those who want—here it comes, folks—"just the FAX," it will keep printing pictures without a lot of fuss, bother, or fooling with.

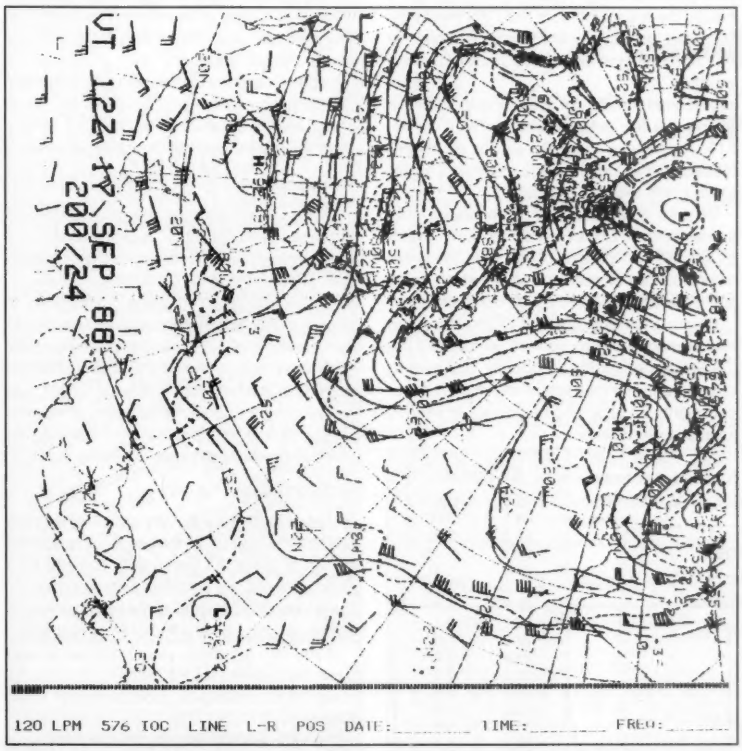

Figure 2. Image of a hand-drawn weather chart. For hand-drawn weatherfax charts, LINE provides the greatest detail and black and white contrast.

73 Review *by Bill Clarke WA4BLC*

The Shakespeare Big Stick

Get into some 10-meter DX with this vertical.

Shakespeare Company
PO Box 733
Newbury, SC 29108
Price Class: $83

In the middle '70s, the Shakespeare Company produced an antenna for the 27 MHz Citizens' Band, called the Big Stick. Now, recognizing the upsurge of sun-spot activity, which means heightened activity on the higher frequency HF bands, the Shakespeare Company revived it as a 10 meter antenna. The current antenna—the Super Big Stick III—is really just the same antenna as before, namely a light-weight Fiberglas™ half-wave vertical antenna. It now comes, however, with a chart of instructions on how to cut it (i.e. trim it for resonance) for operation in the nearby ham band.

A Little Theory

You can describe this vertical half-wave antenna, for ease of visualization, as a center-fed dipole that stands on end. It is a modification of the once popular hypodermic or coaxial antenna. Its Fiberglas™ covering adds strength, durability, and safety. Most importantly, you don't need ground radials with this type of antenna. All you have to install is a single vertical element about sixteen feet tall.

Due to their physical characteristics, vertical antennas are better low-angle radiators than horizontal antennas. For example, a vertical dipole with the feedpoint ¼-wavelength high produces a pattern of radiation from 0–60 degrees, the major portion of which is below 40 degrees. A comparable horizontal dipole radiates at 10–90 degrees, with the major portion of RF going out at higher than 50 degrees. This is important for DXing—low-angle radiation means greater distance per skip.

A quick look at the *ARRL Antenna Handbook* or similar source shows you can obtain very low-angle radiation at a height of only 1-½ wavelengths. This height shows an interesting combination of major lobes at several angles from very low to very high. The height of 1-½ wavelengths is only 24 feet for 10 meters. In the case of the Big Stick, this means you only have to get the bottom of the antenna up about 16 feet from the ground.

Installation

This is very simple. The Big Stick comes in a round cardboard shipping tube and consists of three parts which you merely screw together. There is a metal sleeve at its base which is the attachment point for mounting it. Any typical TV hardware with two attach points will suffice. Check with Radio Shack; they have chimney, vent pipe, eave, and wall mounts. Generally, their hardware costs under $12.

You could also fabricate a mount and put it on a push-up tower. This is what I did, and it placed the feedpoint more than fifty feet in the air. Wind load is very low for this antenna, so I'm not too worried about problems with weather.

I recommend RG-8X coax, unless you wish to spend a few extra dollars for RG-8 or RG-213. Personally, I use RG-8X for all my HF feedlines. It is inexpensive, and much easier to work with than the big stuff.

Be sure you waterproof the cable connection at the base of the Big Stick. For my weather sealing applications, I use glue made for fixing running shoes. One tube, which costs just a few dollars, seals 20–30 connections.

Before installing the Big Stick, trim it to the correct length, as recommended by Shakespeare, for the frequency you plan to operate on. The instruction sheet gives measurements for obtaining resonance at various locations within the band. Use a fine-toothed hacksaw to cut the antenna.

Manufacturer's Specifications

Model 376-GB Gold Band Big Stick III Antenna

Frequency Coverage:	27–30 MHz (adjustable by trimming)
Radiator Length:	approx. 18 feet
Maximum Wind Load:	96 MPH, 86 MPH with 1" radial icing
Polarization:	vertical
Gain:	7.65 dBi
Feed line:	50Ω coax
Connector:	SO-239
Matching Method:	internal (designed for broad-band)
Power Rating:	1000 Watts
Recommended Height:	min. ¼-wavelength (8 feet)
Radials:	not required

SWR Plots

28.0	1.7
28.1	1.65
28.2	1.6
28.3	1.45
28.4	1.4
28.5	1.35
28.6	1.4
28.7	1.5
28.8	1.6
28.9	1.8
29.0	2.1
29.1	2.5
29.2	2.8
29.3	3.0
29.4	3.5
29.5	4.0+

The Big Stick antenna is protected to 14,500 volts against direct contact with power lines. It is protected from lightning by its DC ground.

Performance

First, understand that the Big Stick is an omni-directional antenna. This means that it hears and talks in all directions at the same time. If the band is wide open, you hear wide open in all directions.

The first station I worked was KL7LF, on the third try in a very heavy pileup. He was 5-9, and gave me a 5-7. Before the evening was over, I had worked everything I heard in the Pacific area and many US stations.

SWR readings were favorable (see chart below). Purists look to always get the SWR down to 1:1. Most of the modern transceivers, however, can easily cope with SWR of 2:1 or less in normal operation.

I was pleasantly surprised to find that the Big Stick worked well on 15 meters. The SWR varied from 1.7:1 at 21.0 MHz to 2.1:1 at 21.4 MHz. Nice coverage I had not planned on.

Warranty

Now here's a twist—a real warranty on an antenna. The Big Stick is warranted for 2 years against manufacturing defects in materials or workmanship. Of course, you are responsible for shipping costs if you need to send it to the factory. But now for the zinger: for an additional $10, you can extend the warranty coverage to four years. This makes me think the Shakespeare folks are proud and sure of their product. You just don't offer warranties on any old thing that sits outside in the weather day after day unless it really is good.

In Conclusion

Yep, it works! I was very satisfied with the Big Stick's overall performance. It is easy to put up and doesn't cost much. It might be a good antenna for portable use, also, as the three sections unscrew and can be carried in the shipping tube, which is only six feet long.

If you trim it further, you should be able to peak the antenna for the higher end of the 10 meter band, making it a good performer for 10 FM.

I recommend the Big Stick to any 10-meter enthusiast who can install it at least 16 feet in the air. 73

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A One-Stage 80 Meter CW Transmitter

Home-Brew Fun

by Mark A. Boucher WB3ELL

After your first contact with a rig you've built yourself, you'll understand why old-time hams make such a fuss about the fun they had building their own ham gear in the old days. You may be starting to pale on your several kilobuck all-band transceiver, but I'll bet once you start making contacts with this 80 meter transceiver, you'll be hooked.

I've tried several circuit variations and found that this one uses the fewest parts and gives the best performance. Even better, if anything ever does go wrong with it, you'll be able to fix it yourself. You won't need a modern laboratory to check microprocessor controls.

The only major problem with this transceiver will be getting you to shut up about the fun you're having with it and to stop driving your ham club members bananas. You might just talk'em into making a club project out of it.

Overview of the 80 Meter Transmitter

During receive this radio is basically an 80 meter crystal-controlled self-excited direct conversion receiver; during transmit it is a power RF oscillator. The weakest audible signal is 0.1 to 0.3 microvolts. The power out during transmit is in the 1 to 3 Watt range, and runs on 12 volts DC.

The single stage that this unit uses is an IRF-511 high gain power MOSFET (RS 276-2072). I screwed two Caltronics HS-109 heat sinks to the MOSFET, after spreading thermally conductive paste between them. During receive, this stage acts as a low-level RF oscillator with the RF coupled to a 3-diode detector circuit. The audio output from this is amplified back through the same power FET, going through a 1k to 20kΩ step-up transformer to a quality crystal earphone. This audio output configuration is far more sensitive than anything else that I have tried.

During transmit, the receive section is switched out with the 6-pole T-R relay, and the same tuned circuit is switched back in to become a simple power oscillator. This unit also has a single red/green Tx/Rx LED.

Construction Details

During receive, the antenna (50Ω) is connected to J2 and switched from pins 2–20 of the 6-pole double-throw TR relay through C7

Photo A. The completed DMOS 80 meter CW transceiver.

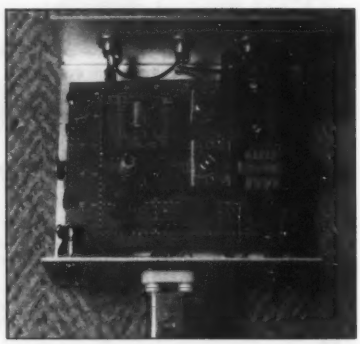

Photo B. An inside view of the DMOS 80 meter transceiver.

to the 8-turn tap of T1. T1 has 30 turns, tapped at 8, of #26 enameled wire on a T50-2 toroid. The high side of T1 is switched from pin 3 to 19 during receive. From there it goes to C15 to the diode detector combination D1,2,3. These are standard germanium detector diodes. The signal injection is through C16, a 2 pF capacitor, to the junction of crystal Y1 and crystal trimmer C2. The output of the detector goes through the parallel combination of RFC1-C14. This combination provides audio coupling and the right amount of RF to cause an increase in sensitivity due to regenerative gain. This is coupled through C5 to pin 13 to 9, which goes directly to the gate of Q1.

Q1 gets the right amount of bias with R1, a megohm trimpot. The drain of Q1 goes to pin 8, which is switched to pin 14 during receive. Pin 14 goes to the 1k ohm primary of audio transformer T2. The 20k secondary goes to the crystal earphone through C20 to J4. Also at this point are C17-C18, which attenuate the higher audio frequencies for a narrower receive bandwidth, and D4-D5 that limit the amount of audio going to the earphone and eliminate a severe transmit-receive keying click.

Crystal Y1 is a general purpose, higher drive fundamental 80 meter crystal (I.C.M. p.n. 031080). This crystal is switched in series with the parallel combination of C2-C19 during receive. C2 is the crystal trimmer adjustment. The receiver is most sensitive when the trimmer is at the minimum capacitance the oscillator will consistently start at. When adjusted to this point, the oscillator frequency is shifted higher by several hundred Hertz. During transmit, this is shorted out to give the oscillator more power and to provide the necessary sidetone shift between transmit and receive to be able to hear stations transmitting on your frequency.

During transmit, the +12 volt supply to the drain of Q1 is switched from T2 to T1 through pins 8 to 16 and pins 3 to 17. The transmit antenna is connected from pins 2 to 18, which then go to C8 and the drain of Q1. The high side of T1, which is already connected to the drain, also has the low side of the 3 transmit tuning caps C11, C12, C13 switched to ground through pins 10 to 11. Also, during transmit, the source of Q1 is grounded through pins 22 to 1.

This radio also has a red/green transmit/receive LED indicator. The +12 volts go through two 1.2k resistors R2 and R3, each to the red or green elements. During receive, voltage to the red LED is shorted to ground through pins 21 to 1. During transmit, voltage to the green LED is shorted to ground through pins 11 to 10, which are isolated from the transmit capacitor ground line by RFC2, the other 330 µH choke.

On the +12 volt input line, through J1, I put D6, a 3A, 50 volt silicon rectifier for reverse polarity protection, and from there to the power switch and filter caps C3,C4.

The keyline comes in through J3, and goes to pin 5, the minus side of RY1, the TR relay. The other side, pin 6, has +12 volts on it. This relay keys normally

Continued on page 30

Number 37 on your Feedback card

HAM HELP

Your Bulletin Board

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Need schematic, etc., for Delco 30BCTS1 from Sam's AR-339. Will pay postage and copying costs.

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Wanted: Manual and schematic for KLM linear amplifier, Model No. 30-140B. Will gladly pay copying and mailing costs.

Edward Moiser N8IOV
4376 Coolidge Road
Coleman MI 48618

I am looking for the following items (please state price and/or condition in correspondence): Two MRF-455 A transistors; MFJ-962, -949C, -941D, or -989 antenna tuner; five 7868 tubes; 10 #12 6-V lamps for Bogen PA Amps; one bandswitch each for the Panasonic RF 2800 receiver #RSR 98W or equivalent; one printer and disk drive for the Tandy Color Computer II Model 26-3127; and one Z-80/CPM and Modem Board for the Apple IIe Pro System.

Mike Adams
Haney Vo-Tech Center
3016 Hwy 77
Panama City FL 32405

I'm looking for manuals and/or schematics for a Heathkit model GR-91 receiver. I'll gladly pay for any costs incurred.

Darrel L. Daley KL7DN
Radio Free Vermont
P.O. Box 445
Putney VT 05346

Does anyone know where I might purchase a new or used TK-1/BC-1 memory backup power supply for my Kenwood TR-7800? It is a small AC adapter that plugs into a wall outlet and retains the memory frequencies in the TR-7800. Thank you.

Michael A. Horn
516 Union Place
Fremont OH 43420

I would like to hear from anyone who uses the Tandy Model 100 and 200 for amateur radio. I am interested in any programs, especially satellite tracking.

Scott Harvey KA7FVV
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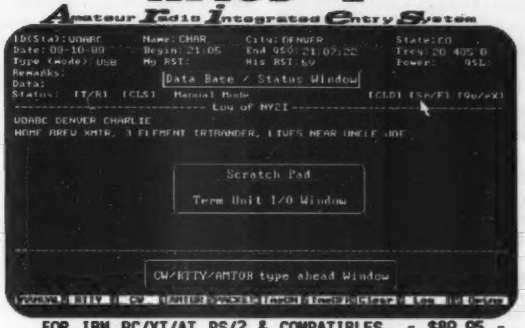

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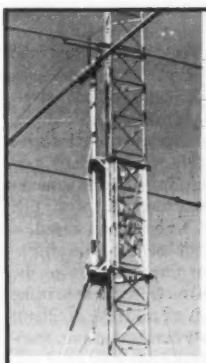
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Continued from page 28

with either a hard or an electronic keyer.

I mounted the parts on top of a Radio Shack 276-16B printed circuit board, and soldered wire jumpers between the different components on the bottom of the PC board. The bottom is quite a mess! It is also important to keep the crystal leads as short as possible, or to mount the crystal on the board itself, as with longer leads. The crystal has lower RF drive going to it, and a tendency not to start. I found this out when I mounted the crystal on the front panel.

Tuning the 80 Meter Transmitter

As for tuning the unit up, make sure that the crystal oscillator is running. The best way is by listening to it on another 80 meter receiver. You would want to make sure that the crystal trimmer capacitor is tightened down all the way, at maximum capacitance, and then adjust the 1 megohm trimpot R1 to the point where the crystal oscillates, which should be about mid-range. Then put an RF signal generator in on the antenna input. Or you could hook the antenna up to it and run a different 80 meter transmitter into a dummy load as a signal source. You then adjust receive tuning trimmer C1, a 600 pF trimmer, for a peak in the audio tone in the earphone. If you do not get a peak you may have to increase or decrease the value of C10, a 150 pF fixed cap.

When you have a peak, the next step is to adjust the crystal trimmer C2 for the least capacitance that the oscillator will consistently run at. You may have to readjust R1 slightly to do this. The next step is to hook this up to a wattmeter, preferably with a dummy load on it. I have a Heathkit HM-9 QRP wattmeter and an HFT-9 antenna tuner that work fine with this unit. Now, with the unit keyed, it should read about 1–5 Watts out during transmit. You should, of course, listen to the transmitter with an 80 meter receiver to make sure that the keying is clean. If the oscillator starts a little too slowly during transmit, readjusting R1 slightly should take care of it.

Transmitting

Next, hook it up to the antenna and try transmitting. If you have a high SWR, Q1 will get quite warm. When this happens, the gain drops slightly. During receive this could cause the oscillator to cut out. You might have to increase the crystal trimmer C2 capacitance or change R1 slightly to make this work correctly. So initially, there is a kind of balancing act between these controls, but when adjusted correctly it is sensitive, stable, and has enough power out to make more than local contacts.

If you have a frequency counter, you might want to make sure that the output during transmit is on 80 meters. If you use a cheap, low-drive crystal, such as a 3579 kHz TV, you could have 40 meter and higher harmonics during transmit, due to the high gain of Q1. You may have to add an 80 meter bandpass filter at the antenna, but with the ICM crystal, and the right values of switched-in parallel tuning capacitors C11, 12, and 13, this is not a problem for me.

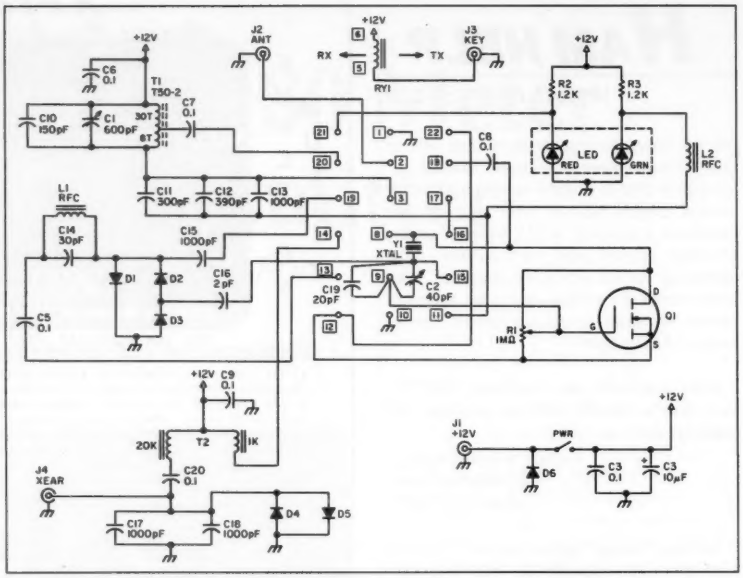

Figure 1. Schematic of the WB3ELL DMOS 80 meter CW transceiver.

Operating the 80 Meter Transmitter

For actual operation, I have a 66-foot, low long-wire, grounded only by water. But I have, even during daytime, contacted KA3CKS, a cousin of mine who lives 12 miles south of here. He has a similar antenna, and a typical 100 Watt output transceiver. At

Parts List

1 Stage 80 Meter CW Transceiver

Symbol	Supplier	Part No.	Description
Q1	Radio Shack	276-2072	IRF-511 N-Channel Power MOSFET
LED 1	Radio Shack	276-025	Red/Green LED
D1,2,3	Radio Shack	276-1123	Germanium Detector Diodes
D4,5	Radio Shack	276-1101	1A,50 V Silicon Rectifiers
D6	Radio Shack	276-1144	3A, 50 V Silicon Rectifiers
RY1	Aromat Corp.	NL6EX-DC5V	6PDT TR Relay
Y1	Intl. Crystal	031080	80 M Experimenters' Crystal
XEAR1	Philmore	747	Crystal Earphone
T1	Amidon Assoc.	T50-2	Toroid
T2	Calectro	D1-719	1k/20k Audio Transformer
RFC1,2	J W Miller	9230-80	330 µh RF Choke
R1	JIMPAK	840P1 Meg	1 Megohm, ½ Watt PC Pot
C1	Calectro	A1-249	600 pF Compression Trimmer
C2	Calectro	A1-246	40 pF Compression Trimmer
C3	Panasonic	A1CV100	10 µF, 100 V Electrolytic Cap.
C4,5,6,8,9,20	Panasonic	21CM100	0.l µf, 100 V Cap.
C7	Panasonic	21CM010	0.0l µF, 100 V Cap.
C13,15,17,18	Panasonic	21CM001	0.00lµf, 100 V Cap.
C12	Elmenco	DM10-391J	390 pF Cap.
C11	Elmenco	DM10-301J	300 pF Cap.
C10	Elmenco	DM10-151J	150 pF Cap.
C14	Elmenco	DM10-300J	30 pF Cap.
C19	Elmenco	DM10-200J	20 pF Cap.
C16	Elmenco	DMIO-020D	2 pF Cap.
SW1	Radio Shack	275-625	Micro Power Switch
J1,2,3	Radio Shack	274-376	Phono Jacks
J4	Radio Shack	276-24B	Mini Phone Jack
YS1	Steatite	33302	Crystal Socket
HS1,2	Caltronics	HS-109	Crystal Heat sinks
PCB	Radio Shack	276-168	Printed Circuit Board
CASE	Ten-Tec	TG-24	Enclosure

night, there is rarely a lack of signals in the 80 meter Novice band. The crystal I have at the moment is 3725 kHz, but I would recommend getting a 3710 kHz, because that is the QRP frequency and, at 3725 and above, there are Canadian SSB stations that cause interference.

The other 80 meter QRP frequencies are 3560 and 3535 kHz, but I rarely hear much activity on those frequencies with this radio. I have made contacts on the Novice band at night, when QRM happened to be at a lull at 3725, with local signals being loud and weaker signals coming from stations further away. With this radio I could not make any more contacts on 3725 than with my Ten-Tec Argonaut using the antenna I have, even though it is a vastly better radio.

One of the possible improvements to this radio would be to add a varicap in place of the crystal trimmer. You could give a crystal high drive to start it switching from transmit to receive, then reduce the drive by cutting back on the capacitance to the point of just oscillating. Also, low drive crystals might work with this and series resistance to the crystal. With this, the radio could work better on 24 volts, where now it has a reduction in gain instead of an increase.

You do not have to use the 6-pole double-throw TR relay. You could, of course, use a front panel 4-pole double-throw switch, and a 2-pole TR relay as long as you put the relay on the source-to-ground contacts, pins 1, 21, 22 and 10, 11, 12. Or you could have three 2-pole, double-throw DIP relays hooked together. Another solution would be to use a 4-pole front panel TR switch, switching the right bias in to the gate of Q1 with the key down.

"As for tuning the unit up, make sure that the crystal oscillator is running."

Personally, I am quite poor at copying CW, but the furthest contacts were in the 200-mile plus range. I had to struggle to pass my 13 wpm code test 12 years ago, but I still enjoy listening to CW and trying to make an occasional contact. I mainly enjoy low-band HF phone contacts.

Since this radio has a direct conversion receiver with a high gain audio amplifier, it will require either a battery with +12 volt supply, or a properly filtered supply to eliminate direct conversion common-mode hum. The Ten-Tec supply I have now works perfectly well as is, with absolutely no hum whatsoever. Any recent *ARRL Handbook* shows the circuitry required to stop this hum.

Problems and Possibilities

Now for a few of the radio's inherent problems. First, I was quite surprised when I hooked this radio up to two different RF signal generators and found that the weakest audible signal was actually 0.1 microvolts. From the volume of received signals, I personally thought it would be in the 10 microvolt range. That is, the receiver is fairly sensitive, but the actual volume is on the low side, unless you are receiving stronger signals. Also, since this has an unbalanced diode detector circuit, it radiates a low-level oscillator on the antenna during receive, and does a great job of detecting AM signals. What this means is that while you can hear the CW signal you are trying to copy, you will also hear any strong local 75 meter SSB, and any strong local or foreign AM short-wave broadcasts.

On 40 meters and higher at night, this radio is totally saturated with AM short-wave BCI. Because this radio has a fairly low volume to begin with, any selective audio filter causes too much of a decrease in volume. The same thing occurs when putting a balanced diode detector on the front end of this receiver: too much of a loss in volume, so the oscillator is stuck with some antenna radiation during receive.

I have spent a lot of time trying to make simple improvements on this radio by adding additional stages. I had a dual-gate MOSFET mixer in place of the diode detectors. It had a slightly higher gain and a greatly reduced tendency to pick up unwanted AM BCI, but it still had the other drawbacks of the original radio. I also tried using the dual-gate MOSFET as a self-oscillating mixer, and the IRF-511 as the audio output. This had a substantially higher gain, but it had problems causing strong receive signals to cut off the oscillator, creating a squeal.

The Solutions

The combination that ended up working the best was a dual-gate MOSFET mixer, an IRF-511 oscillator/audio preamp, and an IRF-511 audio output. During transmit, they easily switched to 1 RF-511 as a power oscillator, and the audio output to a sidetone generator. This, of course, was a lot more sensitive. The signals on the low end of 40 meters at night were quite loud, only occasionally being wiped out by AM BCI, because there was enough audio output to use a CW audio filter. Still, signals on 40 meters daytime were rather weak. So these radios worked, but they still had the major inherent problem of being single frequency crystal-controlled direct conversion receivers. Using a sharp enough audio filter to cut down on interference, you could not tune the signals to a peak because there was no VFO, and a VCXO on 80 or 40 meters is really no good.

Originally, I had planned to sell this idea, or to sell these radios as kits. But given the inherent problems these CW transceivers have, I decided to make the lowband voice transceiver kit that I had started before I began playing around with this. If you decide to make this radio, have fun with it!

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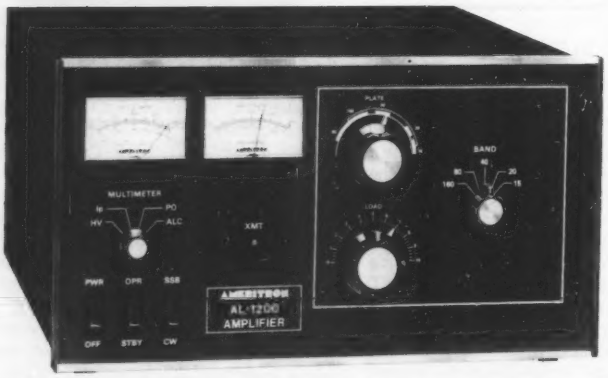

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A peak reading wattmeter and SWR bridge is standard in the ATR-15. It accurately reads envelope powers up to 2KW.

Size: 6"H. x 13¼"W. x 16"D. Wgt. 14 lbs.

Remote COAX Switches

RCS-4 FOR CONVENIENT INSTALLATION

No control cable required.
Selects one of four antennas.
VSWR: under 1.1 to 1 from 1.8 to 30 MHz.
Impedance: 50 ohms.
Power capability: 1500 watts average, 2500 watts PEP maximum.

RCS-8V FOR SPECIAL APPLICATIONS

Selects up to five antennas.
Loss at 150 MHz: less than .1 dB.
VSWR: under 1.2 to 1 DC to 250 MHz.
Impedance: 50 ohms.
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CIRCLE 314 ON READER SERVICE CARD

73 Review by Marc Stern N1BLH

The Ham-10 Antenna

Your ticket to mobile 10 meter fun.

American Antennas
1500 Executive Dr.
Elgin, IL 60123
(800) 323-6768
Place Class: $50

American Antennas has been manufacturing antennas for both ham and CB markets for the last decade. Its first ham antenna was a quarter-wave 2 meter spike, designed for the K-40 mount. The greatly increased activity on 10 meters, due to Novice Enhancement, prompted this manufacturer to market a 10 meter version of their K-40 CB mobile whip. The only difference (besides the logo) is that its radiator is about six inches shorter than that of the 11 meter version.

The base loading coil is uniquely shaped, having a wide barrel-like enclosure for the coil with a top that tapers to the radiator. The body and top are made of high-impact plastic, while the antenna seat is made of stainless steel. The radiator inserts into the mount, with set screws to adjust the length.

The base coil has a quick disconnect feature. Made with a bayonet-style mounting mechanism, the Ham-10's body has a small lip on the bottom. Inside this part you will find the bayonet plate. Simply attach the mount to its base and make a one-quarter turn to the right, and the Ham-10 securely locks home. At this point, the antenna is ready to use.

An interesting sidepoint about the antenna's trunk lip base is its flexibility. A low-profile base, it has more than thirty degrees of tilt from vertical in a 360-degree arc. You should be able to mount it on just about any angle you can think of on your car. For example, our Ford Taurus has an interesting curl on the trunk lip, but I was able to flush mount the Ham-10 and position the radiator vertically.

I found it a lot easier to work with this base than several other antennas I have tried. About the biggest difficulty in setting the antenna up is the angle.

Setting'er Up

To set up the antenna, I first had to loosen a set screw in the base. This allows the mount to float freely in its arc. The second step is installing the mount loosely on the trunk lip so that you can find the correct angle. And, when this is done, the next step is marking and removing the mount and positioning the base so that it is at the correct angle. In practice, I found it required a couple of tries before everything lined up correctly. In fact, once I did it, it was easy to repeat the process when I moved the mount. However, until I was familiar with the procedure, I thought I'd need as many arms as an octopus. Yet once the set screw is down and tight, you don't have to think about it anymore.

Dave Hallow KE9BD, designer of the Ham-10, with his product mounted on his car.

Easy TX Line Routing

The antenna is actually designed with ease of installation in mind. For example, most antennas come with PL-259 connectors installed. This makes it a bear, sometimes, getting the cable through small holes in bulkheads. Recall skinning your knuckles while trying to snake a piece of RG-58 through a bulkhead hole, containing what seem to be several dozen stiff wires, all bent on keeping you from achieving your aim? The Ham-10 has what seems to be a variation of an F-style connector in the end. Threaded, you insert it into the bottom of the PL-259, *after* you have snaked the cable through whatever bulkhead holes to get the coax into the passenger compartment. It makes it easier to snake the cable under moldings, making the cable installation neat and out of sight.

As was noted earlier, the matching coil is a large, barrel affair that sits beneath the radiator. The literature states that the the coil and its housing are manufactured, rather than handmade or turned.

I've had an 11 meter coil for about a decade, and it seems to work the few times a year I throw that particular radio and antenna combination into the car.

Off The Ball

The radiator is somewhat a departure from the norm. Rather than using a corona discharge ball or device at the tip, as do most other antenna manufacturers, American Antenna relies on a thick radiator. It is roughly ¼" in diameter, with a rounded tip.

Tuning

Tuning was handled via a set screw and a wrench. The instructions advised inserting the radiator so it touched the bottom of the mount, and then backing it out about ¼". I did that, and the rig I used, a Clear Channel AR-3500 Ranger, worked well. I felt that was pretty good for tuning an antenna without a VSWR bridge. Yes, I did have one with me, but I wanted to see if the instructions were right, and if the information underlying them was valid, which it was. Then I connected the VSWR bridge and obtained the readings noted.

The Ham-10 tuned up easily and remained at better than 1.8:1 across the 10 meter band.

Power

American Antenna claims the Ham-10 will handle a kilowatt. I didn't test it, but, given the heft of the coil and housing, it's a reasonable bet. During my 100 watt testing, the base remained cool and the radiator also remained cool. I would think that things would heat up rapidly if you pushed the power to a kilowatt. I'd also suspect that the plastic housing might turn into something a little less rigid than it is at that kind of power for a continued length of time. It's reasonable to think, though, that for power levels up to about 300 watts the Ham-10 will do quite nicely.

I personally prefer not to run a kilowatt down RG-58. I suppose it's possible, but I wouldn't want to chance this combination on my rig. It is a good one for lower-power operation, but I prefer at least RG-8X for mobile high-power work.

Conclusion

If you're in the rapidly expanding army of 10-meter mobile enthusiasts, the Ham-10 is a good idea. It's an easy antenna to use and should give reliable performance for years. Just don't forget to mount it cleanly, and make sure the ground is good, and you're on your way to 10 meter fun. ■

73 Review

by Gordon West WB6NOA

Magnus Mobile kW Amplifier

QRO for the road.

Magnus Electronics
7101 Ridgeway Avenue
Lincolnwood, IL 60645
PH: 312-690-3205
Price Class: $1000

Looking for some additional kick to your mobile, mobile marine, or mobile home HF installation? If you've got an antenna system that can take it, the Magnus MA-1000B mobile amplifier "brick" will deliver a 2–30 MHz signal well above 600 Watts output!

The Magnus amplifier has been around for some time. I remember it as the "Mectron," originally produced by Trans World Radio in Escondido, California. I was always fascinated by its capabilities—100 Watts in, 600-plus Watts out! Completely broadbanded and all solid-state, its most exciting feature was 12 volt operation.

After a few months of hibernation, this amplifier has now reappeared under the "Metron" name, and is available from leading amateur radio dealers throughout the country. My unit was purchased from EGE when I was working next to them at our Radio School in Boxboro, Massachusetts. The amplifier is manufactured by Magnus Electronics. They don't sell direct; the amplifier is available only through authorized ham dealers.

Description and Specifications

This amplifier weighs 18 pounds and measures 4 inches high, 10 inches wide, and 18-½ inches long. It's designed for trunk-mounting with full remote control capabilities. Positive and negative studs with wing-nuts allow for immediate 12 volt DC hookup. The unit should be placed extremely close to a battery or a battery selector switch. For this amp, use the same wires that start your car. It draws up to 75 amps at 12 volts DC on voice peaks. There will be a significant power loss if you run anything smaller than #4 cable at any distance.

A common SO-239 antenna jack runs the output to your HF antenna system. If you're running mobile resonators, make absolutely sure you have the kilowatt coils. The 600 Watts of output will melt down anything smaller. Also make absolutely sure that any antenna system with this type of power on it can't be touched by anyone on the ground.

Also on the back of the unit is a multi-pin jack and a plug that allows for remote bandswitching. This amplifier is completely broadbanded, but each meter band must be selected in order to pull in the appropriate harmonic filters. For base station use, the remote control socket does select the bands of operation right on the front panel.

The best news is that the filter combination does not preclude the operation on any general group of frequencies in an emergency, such as marine frequencies. As you can see by the low-pass ranges, there is uninterrupted coverage from 1.8 MHz through 21.450 MHz. You may also extend the coverage up to 10 meters, or 29.7 MHz, with the optional ham-installed 10 meter add-on kit. More about that later.

The 5-Pole Tchebycheff Low-Pass Ranges

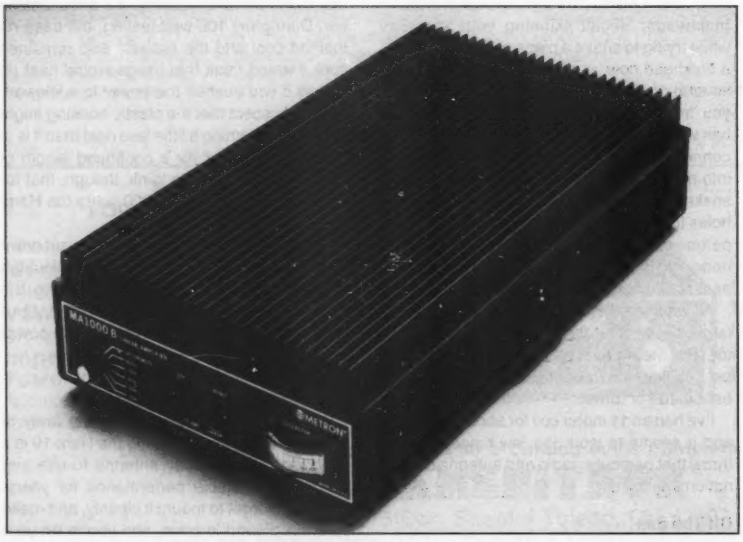
160m	1.8–2.0 MHz
75m	2.0–4.0 MHz
40m	4.0–7.5 MHz
20m	7.5–14.5 MHz
15m	14.5–21.5 MHz

There is also a pin that needs to be grounded to toggle the amplifier to transmit. This keying line is switched on by grounding the control line. You can switch the control line by using the exciter control relay built into almost every HF transceiver available today. You can also switch the amp completely off by using the circuit breaker on the front panel or, for remote control, by grounding the control line pin on the amplifier's rear contact. I measured 50 mA when the amplifier had been left on continuously. You can hear a couple of relays pull in when the amplifier is ready to go.

Construction

The front of the amplifier looks clean. It has a simple panel meter, 100 amps full scale, monitoring the collector current. This gives you an accurate monitor of amplifier performance, provided the amplifier is operated into the correctly matched load. There is also a high-speed, 75 amp magnetic circuit breaker on the front line. This circuit breaker immediately pops open if you try to overdrive the amp, or drive the amp on any ham band that you have not selected with the filter network.

An SO-239 on the back of the amp ties power output from your HF transceiver to the amplifier input. The amp likes to see about 75 Watts PEP input. Most HF solid-state transceivers will work nicely with the amp without any power changes. However, if you have fiddled with the ALC on your HF



The Magnus MA1000B mobile linear amplifier.

transceiver for more power output, you may want to cut your transceiver back to no more than 75 Watts PEP so you won't overdrive the amp and trip the breaker. We found that a constant breaker trip usually means that too hefty a signal has been sent into the amp.

The amp also shut down when we exceeded 75 degrees transistor heat sink temperature. It took me almost an hour with voice into a dummy load before this occurred!

The heat sink is on the top of the amp and forms the top of the chassis, which is constructed of 0.090 aluminum and is bolted to the heat sink. The entire amplifier is heat-sinked, and finished in an attractive hard-wearing black anodizing. We judged the construction of the amplifier to be "excellent."

The 10 Meter Kit

I also added the 10 meter kit. Unless you like working on these projects, pay the price and let the dealer do it for you. While it's not a tough job, you have to really strip down the amplifier to get at the filter board so you can remove capacitors and toroids and add new capacitors and inductors. You need a big soldering iron for this job, and you also need to know what you're doing when it comes to mounting electronics on a printed circuit board. The 10 meter kit instructions are fairly well-written, although they instruct you to remove some capacitors that aren't even on the PC board.

After a few hours, the modification for 10 meters was complete. Now the unit covers from 1.8 MHz all the way through 29.7 MHz. With 75 Watts of PEP drive power, I measured over 640 Watts of PEP power output with an in-line Bird wattmeter. We double-checked our readings with a B&W Model 334A wattmeter and dummy load. Same thing: much better than 640 Watts out. It wasn't long before the red overheat warning light of our dummy load and wattmeter started blinking, indicating that there was plenty of power coming out of this amp.

The MA-1000B is rated at a power input of 1,000 Watts to the eight power transistors operating as four push-pull amplifiers. The transistors use an emitter-ballasted chip design to control impedance and gain over a bandwidth of more than a decade. The amplifier operates Class AB with a computer-designed input network using a combination of inductors, resistors, and capacitors to provide a low input VSWR and substantially level gain across the operating range.

The broadbanded transistor amplifier has a relatively high level of harmonic output, but the even-order harmonics tend to balance in the push-pull output transformers, and the odd-order harmonics are not attenuated. A filter is essential to insure satisfactory spectral purity. The filter design used is a low-loss, 5-pole, Tchebycheff with a low reflection coefficient. We looked at our output on a spectrum analyzer, and harmonics were well within legal limits: down a measured −55 dB. Relays are employed at the input and output of each filter so that you may select the filters by remote control, or off the front panel.

The MA-1000B in Action

On-the-air reports indicate smooth-sounding audio. This is an important consideration. Many times solid-state, broadbanded amplifiers tend to make transmitted audio sound harsh. No such reports on the MA-1000B.

We operated the set maritime mobile into a kilowatt MFJ tuner. Again, results were excellent. When we switched the amplifier on, our signal strength rose by several S-units, and everybody commented on the exceptional "talk power," as well as the relative increase in signal strength. We hooked up with one station for approximately one hour, and then felt the fins of the amplifier. It was relatively warm, but not hot. Power still continued to exceed 600 Watts PEP output with less than 75 Watts power input drive.

We tried the amplifier in a vehicle on several mobile whips that were NOT rated at a kW. We found that we could talk for about 25 seconds before the whips would zap and give up the ghost. This was an interesting test. It drove home the point that most mobile whip antennas not rated at a kW simply can't handle 600 Watts of PEP output.

Be Safe!

WARNING: Observe great caution when operating maximum output, whether from a mobile at rest or in motion. This type of power could cause severe RFI into the electronic ignition system of some vehicles. It also poses a dangerous level of power around passers-by, who sometimes touch antennas as they walk by. Anyone touching the antenna during voice peaks will receive, at the very least, a nasty RF burn. Observe the same caution with dipoles in trees. 600 Watts is enough to light almost any type of tree on fire, if the branches or leaves come in contact with the wire.

It's also a good idea to watch your battery. Although the 75 amp peak occurs only on modulation peaks, it nonetheless will kill a battery in about three hours of constant talking. After a longwinded conversation, we still had enough power to start our engine, but it didn't spin over like it normally does when the battery is full. Also, feel your battery leads with the MA-1000B drawing current. If they're getting warm, you may need to switch to a larger diameter cable.

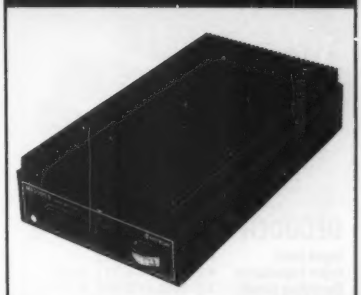
Manual

We were impressed with the MA-1000B's instruction manual. It's technical enough to give you plenty of information about running the amplifier, knowing your amplifier, and, if need be, routine servicing of the amplifier.

The 10 meter add-on kit is available to all licensed hams. This hand-drawn set of information sheets, along with a bag full of components, is written relatively well, but the quality of the reproduction could be improved for greater legibility.

If you're looking for 600 Watts out, and want to run it off 12 volts DC, and you want complete band coverage from 1.8 MHz through 29.7 MHz, consider the Metron solid-state, 12 volt, DC linear amplifier. It's priced right at less than $1.50/watt output, and it's a terrific mobile performer. 73

1000 WATTS
MOBILE LINEAR
160 M - 15 M



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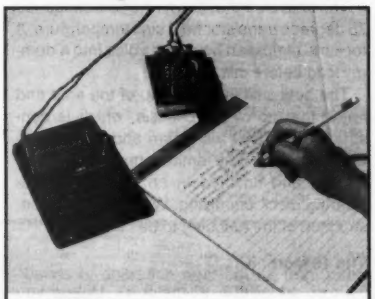

TRAINER

Code generator	• Random code generator 5 characters/code group
Speed	• 5 WPM to 30 WPM 1 WPM increment

ELECTRONIC KEYER

Paddle input	• TTL level —LO/Actuating, HI/Stop Contact input —ON/Actuating, OFF/Stop
Key input	• TTL level —LO/Mark, HI/Space Contact input —ON/Mark, OFF/Space
Keying speed	• 5 WPM to 30 WPM 1 WPM increment
Keyer output	• Transistor switching, Open collector type

SPECIFICATIONS

Model	• AR-501 Radio telegraph terminal
Power source	• DC 12V to 13.8V—165mA
Size	• 4.5"-W x 2.24"-H x 6.25"-D
Weight	• 12.5 oz. (358 g)
Controls	• Power On/Off • Random code generator On/Off • Print-out On/Off • Monitor speaker level • Electronic keyer mode select • Speed Up & Down
Display Indicators	• LCD 32 characters—16 per line • Power On—Green LED • Tuning—Red LED
Front connections	• Paddle—Standard/Iambic • Ordinary telegraphic key • Headphone/Earphone
Rear connections	• DC 13.8V input • Audio input • External speaker • Keyer output • Printer output

PRINTER PORT

• Compatible with Centronics 8-bit parallel printer. At least 4K byte data buffer is required in a printer.

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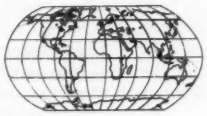

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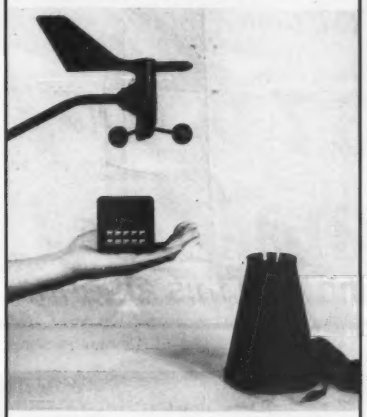

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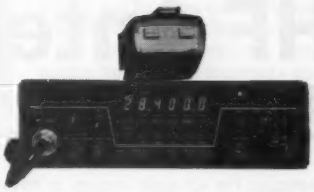

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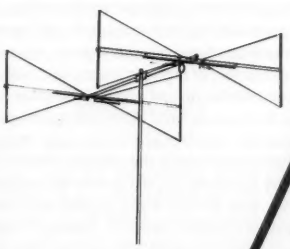

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 by Chet Lambert W4WDR

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Although I'm not lucky enough to have a laboratory to back up my research on the Pro-67, I have good old down-to-earth everyday use. Most hams, however, find an "operational" review sufficient for their needs.

What It Is

The Mosley Pro-67 antenna is a 7-element, 6-band antenna. The Pro-57 is a sister antenna, with 7 elements and 5 bands. The only difference between them is that 40 meters is added to the Pro-67. Both have a two-year warranty.

All seven elements (average wall thickness is 0.058") fit on a 2" x 0.125" 24' boom. The boom doesn't require any additional support. The elements, made of stainless steel, are heavy-duty. The only elements that sag are the two 42½-foot long driven elements.

There are three wide-spaced elements on 20 and 15 meters. Ten meters has four wide-spaced elements. There are three elements on 12 and 17 meters. Forty meters has two elements.

Putting It All Together

Pro-67 assembly went very smoothly. Charles Spanos N4DKE and his brother Michael KA4VCA put it together (see Photo B). They gave me just enough work to do to make me think I was a help. My greatest contribution was to provide plenty of ice tea . . . and to keep out of their way.

Here, as in most cases, it's a good idea to first thoroughly read the manual. Also, we found out the hard way that we needed PLENTY of room to move around in when putting together the Pro-67. I made do by putting some of the longer elements into our garage.

Check the parts to be sure you have everything the manual calls for (see Photo A). Don't worry too much about the screws, bolts, and nuts. There are extras, for people like me, who keep forgetting just where he put them—then finds them with his foot, scattering them like a meteor shower.

Put the pieces for each element in a separate pile (don't worry, they're color-coded). Put the boom pieces together, which are also color-coded.

Lay out the elements in the position they will take on the boom.

Photo A. Pre-assembly check. Make sure you have all the parts listed in the manual. [Photo by David Reasoner N4KTY.]

Take care with the traps placement. They are color-coded on one end only! Place the color-coded end nearest to the boom. A reversal of the traps will cause high SWR (standing wave ratio) and could affect other workings of the beam.

The only measuring needed was to check distances between elements on the boom. The element pieces themselves are pre-cut and pre-drilled as well as color-coded. All we had to do was match colors, align holes, and screw everything together. The boom is color-coded to assist with element placement. I recommend, however, getting exact measurements for best results.

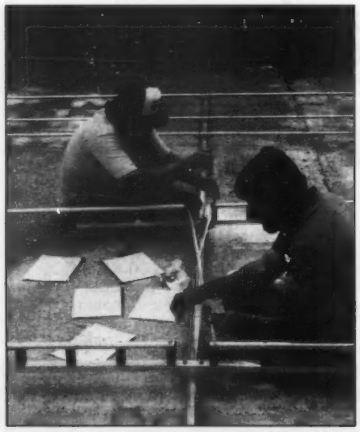

Photo B. Charles Spanos N4DKE and his brother Michael KA4VCA put the Pro-67 together. [Photo by Christie Lambert.]

One of the main strengths of the Pro-67 is the way the elements go together. The machined elements fit so closely it would be difficult to get even a hair between the pieces. Also, the portions of the elements and booms sections that fit inside their adjoining sections are very long. They are so long, in fact, that they meet the end of the inside portion of the section that fits in the other side of the adjoining section. This make the antenna virtually double-strength! This is the other main factor for minimal element sagging. It's common for beams to have only a foot or so overlap.

Assembly Time

The instructions give a 2½ to 4 hour assembly time. It took us one day. We took, however, extraordinary preventative measures. Charles N4DKE didn't want to put Penetrox (an anti-corrosion compound) to prevent the development of high resistance and seizing of the aluminum on just parts of the antenna; he had to have us take each coil apart and put Penetrox everywhere there was metal-to-metal contact within the coil (see Photo C).

The last thing we did before we raised the beam was to coat it thoroughly with Mosley Weather-Guard® antenna coating. I recommend buying at least one can with the antenna. This will give at least one coat on the antenna. The instructions on the can say it will dry in twenty minutes, but I made sure and let mine dry much longer. These extra steps took time but the time was well worth the effort. Follow the directions carefully; do not apply the coating to plastic parts.

Mounting the Antenna

I mounted my Pro-67 on my 90' + Rohn 25G tower. I recommend, however, a tower at least as heavy-duty as the Rohn 45G.

Several Nit-Picks

The instructions I got were about a dozen and a half pages, which appeared to be photo-

copies. I have since then received a final set of twenty-seven pages that were more professional looking, especially the diagrams. Although the new set was better, I feel they could still be improved with desktop publishing.

Combining the instructions for both the Pro-67 and the Pro-57 is a little confusing, since the assembly steps regularly differ for the two beams. Mosley would do well to to print a separate set of instructions for each antenna.

One other thing I didn't agree on was the first step of assembly. That was the placing of the phasing lines to the elements. It is difficult to understand this without seeing the results. Doing it their way, there's a stage of very weak physical stability in the antenna. I feel this could be easier done as one of the last steps when there is more stability by having the boom and elements forming one strong unit.

Dave Reasoner N4KTY of Huntsville made a slight modification on the attachment of the metal strips to the SO-239 point (see Photo D). Dave added a second ground strip, the new one going from one of the elements to one of the mounting screws for the SO-239 connector. Other than the above, the antenna went together as Mosley said it would.

Photo C. Charles N4DKE insisted we put Penetrox not only on the aluminum parts, but everywhere there was metal-to-metal contact. [Photo by author.]

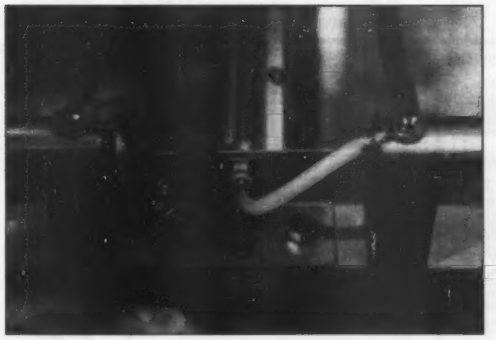

Photo D. Dave Reasoner N4KTY of Huntsville made a slight modification on the attaching of the metal strips to the SO-239 point. [Photo by N4KTY.]

Up and Going

This was the most difficult task of the entire project. Our lot is fairly small, we had a lot of trees, (at least in the wrong places), and the tower guys were also a hindrance. I at least had a full crew of able-bodied people to help: Charles N4DKE, Mike KA4VCA, Paul N4JTD, Teenie WA4REL (my XYL), Christie (my daughter), Kerry (my son), and my neighbor LeRoy.

PERFORMANCE

SWR

Here, I found a discrepancy in the paperwork that came with the Pro-67. The SWR (Standing Wave Ratio) charts showed more SWR than I got from using a Daiwa CN-520 SWR/Power meter. My highest SWR is on 40 meters, where at one point it is 2:1. All other readings are less than that, and at times, below those stated by Mosley. (See table below.)

Manufacturer's Specifications	
Band (Meters)	Claimed Forward Gain (dBd)
10	10.9
12	6.0
15	8.9
17	6.9
20	8.5
40	3.5

Make Sure It's Aimed!

I was impressed with the Pro-67's front-to-back ratios. Recently, one night after midnight, I turned on my ICOM IC-751 and began tuning around. Twenty meters seemed abnormally quiet for that time of night, especially given the fabulous conditions on HF for the past few months. Ten and 15 meters weren't any better. I soon gave up and headed for bed.

Frequency (MHz)	SWR
7.0	1.55:1
7.15	1.1:1
7.3	1.55:1
14.0	1.4:1
14.175	1.1:1
14.35	1.4:1
21.0	1.25:1
21.3	1:1
21.45	1.2:1
24.5	1.45:1
24.7	1.6:1
25.0	1.3:1
28.0	1.35:1
28.25	1.1:1
28.5	1.1:1
29.0	1.2:1

Table 1. Observed SWR for the Pro-67 Antenna System. SWR meter was a Daiwa CN-520.

After turning out the lights, I started to leave the room; however, I noticed I'd left my Tailtwister™ rotor control box on. (I had Mosley's Pro-Search to modify it to an LED (light emitting diode) readout. A smart move. . .) When I went over to turn it off, I noticed it was setting on 37 degrees, which is where I normally work European stations. On a hunch, I turned on both my 751 and control box, turned the Pro-67 toward the South Pacific, and found the band wide open. I worked several countries. After making a few contacts, I turned the antenna back to the European countries—again, the band appeared dead. This little event showed me that the Pro-67 has a much better than average front-to-back ratio for its class.

In Sum

I was *very* impressed with the Pro-67. Of the several dozen beams I've erected in my 27 years of hamming, this was by far the easiest beam I've put together.Its performance, too, was outstanding. Using the Pro-67 with my ICOM 751 transceiver and 2KL (500 watt) amplifier, I received great reports from many DX stations. Many told me my signal was "the strongest signal I heard today," and "the only stateside station I can hear." A few days after I got the antenna on the air, my log looked like a DXCC listing. With about 18 hours of operating, I logged 38 countries, including Meralda VR6FWK (Pitcairn Island), Ken HB0/DA1WA (Leichtenstein), Mohammed 9K2MQ (Kuwait), and Paul 4X6UU of the Natanya Island DXpedition. For those with limited power out and a bit of a space crunch (i.e. no room for more than one tower), I highly recommend the Pro-67.

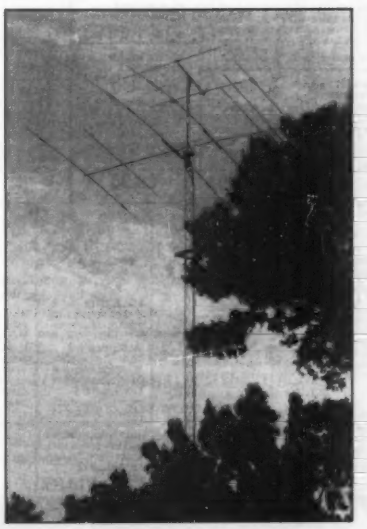

Photo E. The installed Pro-67, ready for action. [Photo by author.]

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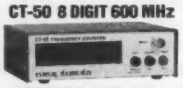

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CT-125	10 Hz-1.25 GHz	<25mv @ 50 MHz <15mv @ 500 MHz <100mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
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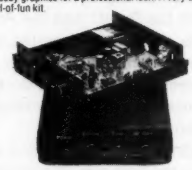

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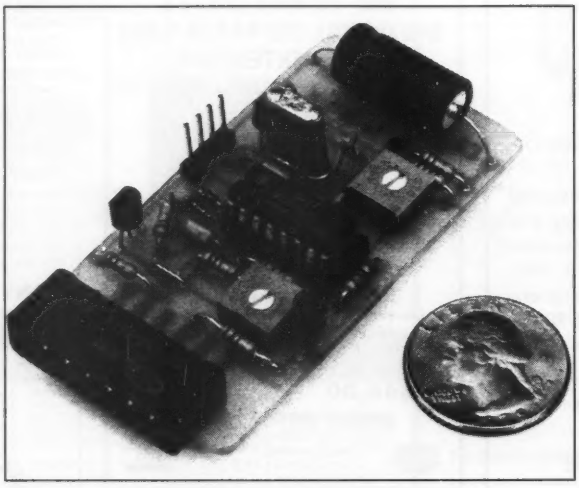
TCM 3105 Modem for the Digicom > 64

A mini-modem for 1200 Baud packet.

by Craig Rader N4PLK, John Krohn KJ4GP, Sam Baine W4KUM, and Mike Zinicola WD4PVS

Another modem for the Digicom > 64 TNC Emulator program? Yes! This one is different from Barry W2UP's packet modem (see the August 1988 issue of *73*) in that it works exclusively on 10 meters, VHF, and UHF at 1200 baud. It's cheap and very small —so small, in fact, that some Digicom enthusiasts are installing this little jewel *inside* their Commodores!

The prime mover of this simple modem is a single 16-pin modem IC, the TCM 3105, manufactured by Texas Instruments. This IC, powered by 5 volts, handles all modulation/demodulation functions digitally. You can attach it directly to the cassette port of the Commodore 64 and 128. Because the TCM 3105 consumes little power, you may operate other programs and peripherals concurrently.



Get on 1200 KB packet with this little gem.

Get on 2 Meters Quickly and Cheaply

If you have operated HF packet, you know that the mode is difficult even with expensive interfaces. A tuning aid, such as an oscilloscope or LED bar graph, is necessary. Sophisticated filtering, such as that found in expensive modems, is also desirable. If you're a newcomer to packet, you may not want to get involved in all that at first. For packet newcomers, 2-meters is the place to start, and this modem will get you on there quickly and cheaply.

The idea for this modem came originally from the West German authors of Digicom. In their German program documentation, we include a basic, hand-drawn schematic. Over time, as a result of use and testing, we made additions and modifications. For example, we added front-end audio limiting and a watchdog timer. With the aid of applications engineers at Texas Instruments, they made several circuit modifications to improve the modem's sensitivity.

We came up with the following PC board and construction design to make the Digicom program more accessible to people. We hope that the low cost and ease of construction will encourage more newcomers to join the packet mode.

Assembly

The component layout diagram (Figure 2) shows the PC board parts mounted as they appear on the non-foil side of the board. Hold the PC board up to a light to see the foil traces on the opposite side, and use these traces to guide you in parts placement.

The design uses a right-angle, six-contact card-edge connector (Dale EBT156-6R1W). It's possible to use a regular solder tail connector, as the solder points will line up the bar traces on the PC board. Apply a thick line of plastic cement to the board/connector joint in this case, to prevent the solder tails from breaking off. The PC card is installed in the Commodore's cassette port, *foil side down*.

Note carefully the orientation of the IC and ensure that the IC socket is soldered correctly for proper orientation of the chip. Do not install the IC until soldering is complete and the board has been tested for shorts.

When assembly is complete (and before installing the IC), make a continuity check between pin 2(B) of the cassette port connector and the other pins. As you look straight at the computer side of the connector, with the non-foil side of the PC board up, pin 1(A) is at your right and pin 6(F) is at your left. With R9 turned fully counterclockwise, there should be at least 100kΩ between pin B and the other pins. If there is less resistance, you have a solder bridge somewhere. Check the entire PC card carefully for solid solder connections and solder bridges.

You will need to make four connections to your transceiver: push-to-talk, microphone, speaker (audio from the transceiver), and ground. You're lucky if you can get audio from the front panel of the rig (as in the new ICOM models) because then you'll need only one cable. If you can get audio only from a separate jack on the rig, then you'll need a separate cable. Join the ground from the audio line with the ground from the MIC/PTT line at the PC card.

If you use an HT with this modem and the HT's PTT circuit is combined with the MIC circuit, then join the two lines from the modem before they reach the jack on the HT. This is normally done with a resistor in the PTT line and a 0.1μF capacitor in the MIC line. The value of the resistor varies with the brand, but 3.3kΩ works with the Yaesu and 30kΩ with the ICOM. If you have a friend

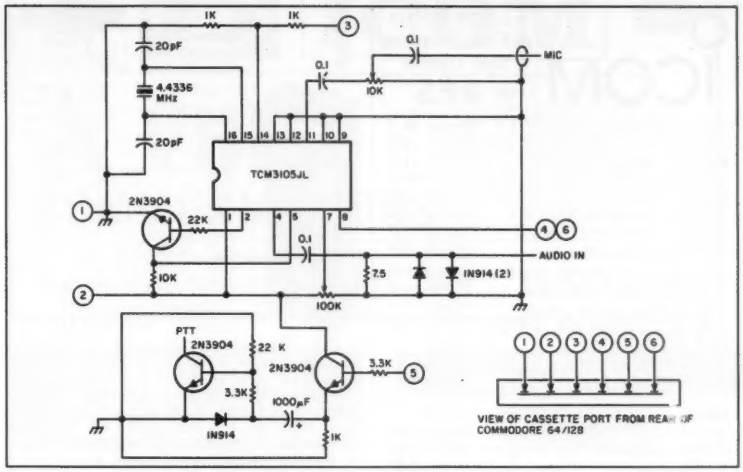


Figure 1. Schematic for the plug-in modem for Digicom > 64.

with a TNC, ask him what the directions say for connecting your brand of HT to his TNC. Whatever works for TNCs will work for this modem.

There are some transceivers, particularly those with PTT relays, that won't key up with a small transistor like the one used on the modem board. If you have such a transceiver, you could insert an opto-isolator, such as a TIL-119, in the circuit. This low-cost, 6-pin IC will key transceivers with PTT voltages as great as 100.

Pinout for the TIL-119

1. Connect to pin 2 of the cassette port (5 volts) through a 3.3kΩ resistor.
2. Connect to the PTT pin on the modem header.
3. No connection.
4. Connect to negative side of transceiver PTT circuit.
5. Connect to positive side of transceiver PTT circuit .
6. No connection.

Tuning and Testing

Install the IC chip, correctly positioned, into its socket and install the modem into the cassette port while the computer is off. Turn the computer on and feel the IC chip. If it is warm at all, turn off the power and remove the modem from the cassette port. Recheck the modem for IC orientation, solder bridges, and incomplete connections.

R9 adjusts the receive bias of the TCM 3105JL. The quickest and easiest way to make this adjustment is to boot up the Digicom program when the packet frequency is busy, and adjust R9 until Digicom starts printing data. Of course, you must have the monitor functions of the program turned on. Alternatively, you can adjust R9 for the presence of the correct voltage on pin 7 of the IC chip. With 5 volts applied to the modem, R9 should decode when 2.26 volts are present at pin 7. Digicom doesn't have to be running, but be careful not to short adjacent pins with the voltmeter probe.

R4 controls the AFSK audio output from the modem to the MIC input of your transceiver. You don't want to overdrive your rig so adjust it for the minimum output that will give reliable reception. Send UNPROTO packets via a local digipeater and watch your screen. If you see your rig transmitting, but the digi is not repeating your data, you know the output is too low.

A 30-second watchdog timer incorporated in the modem design should be adequate for any packet transmissions. If longer time-out periods are desired, you may increase the value of C6. However, remember that the sole function of this timer is to drop out the PTT circuit if it is accidentally keyed while you are not present. The longer the time-out period, the greater the chance of frying your rig. Be conservative and go with the shortest time-out period.

Parts Availability

The following distributor is given as a source for the TCM 3105JL modem IC, the 4.4336-MHz crystal, and the 6-pin (double) card-edge connector, although other distributors carry the parts: *Active Electronics, 133 Flanders Road, Westboro MA 01581; 1-800-228-4834.*

Complete kits will be available at the price of $38.50 plus postage (US and Canada, $2.50; other countries, $5.00). These kits will include a high-quality printed circuit board and all components necessary to get the modem on the air, excluding the transceiver cable. Money orders in US currency only, please. Contact *Craig Rader N4PLK, 922 Baltimore Drive, Orlando FL 32810-5531.*

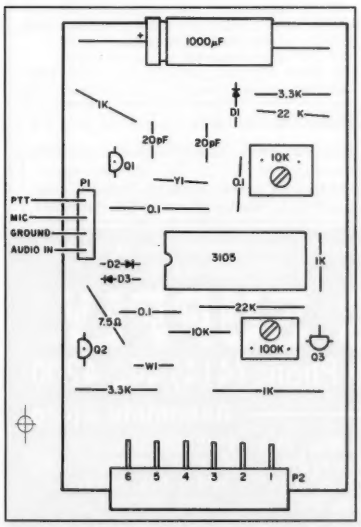


Figure 2. Parts placement diagram.

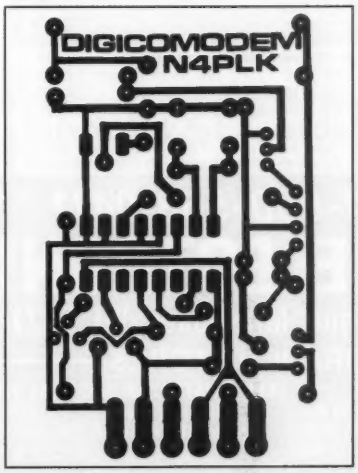


Figure 3. Etching pattern for the PC board.

Parts List

Resistors

R1	1k	R7	10k
R2	3.3k	R8	22k
R3	220k	R9	100k single-turn pot
R4	10k	R10	1k single-turn pot
R5	1k	R11	3.3k
R6	7.5Ω		

Capacitors
Poly, Mylar, or tantalum

C1	20pF	C4	0.1µF
C2	20pF	C5	0.1µF
C3	0.1µF	C6	1000µF (electrolytic)

Other

D1, D2, D3 1N914 diodes
Y1 4.4336 MHz HC-18 case crystal
Q1, Q2, Q3 2N3904 NPN transistors
U1 TCM 3105JL FSK Modem IC
P1 4-pin header (0.1" spacing)
P2 6-pin card-edge connector (Dale EBT156-6R1W)
W1 wire jumper
16-pin IC socket (PC mount)
Case (if desired)
4-conductor shielded transceiver cable
Audio cable (if required)

HF Equipment	Regular	SALE
IC-781 Xcvr/Rcvr/ps/tuner/scope	5995.00	Call

IC-761 Xcvr/Rcvr/ps/tuner	2699.00	2369
HM-36 Scanning hand microphone	47.00	
SP-20 Ext. speaker w/audio filter	149.00	139.95
FL-101 250 Hz 1st IF CW filter	73.50	
FL-53A 250 Hz 2nd IF CW filter	115.00	109.95
FL-102 6 kHz AM filter	59.00	
EX-310 Voice synthesizer	59.00	

IC-751A 9-band xcvr/.1-30 MHz rcvr	1699.00	1469
PS-35 Internal power supply	219.00	199.95
FL-32A 500 Hz CW filter (1st IF)	69.00	
FL-63A 250 Hz CW filter (1st IF)	59.00	
FL-52A 500 Hz CW filter (2nd IF)	115.00	109.95
FL-53A 250 Hz CW filter (2nd IF)	115.00	109.95
FL-33 AM filter	49.00	
FL-70 2.8 kHz wide SSB filter	59.00	
RC-10 External frequency controller	49.00	

IC-735 HF transceiver/SW rcvr/mic	1099.00	949.95
PS-55 External power supply	219.00	199.95
AT-150 Automatic antenna tuner	445.00	369.95
FL-32A 500 Hz CW filter	69.00	
EX-243 Electronic keyer unit	64.50	
UT-30 Tone encoder	18.50	

Other Accessories	Regular	SALE
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PS-15 20A external power supply	175.00	159.95
PS-30 Systems p/s w/cord, 6-pin plug	349.00	319.95
MB Mobile mount, 735/751A/761A	25.99	
SP-3 External speaker	65.00	
SP-7 Small external speaker	51.99	
CR-64 High stab. ref. xtal for 751A	79.00	
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SM-8 Desk mic - two cables, Scan	89.00	
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AT-500 500W 9-band auto. antenna tuner	589.00	519.95
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IC-375A 25W 220 FM/SSB/CW (c/o)	1399.00	899.95
IC-475A 25W 440 FM/SSB/CW w/ps	1399.00	1099
IC-475H 75W 440 FM/SSB/CW	1599.00	1289
IC-575A 25W 6/10m xcvr w/ps	1399.00	1129
IC-575H 100W 6/10m xcvr	1699.00	1499
IC-471H 75W 430-450MHz base (c/o)	1399.00	989.95
PS-35 Internal power supply	219.00	199.95
AG-35 Mast mounted preamp	99.95	
AG-35 (Purchased with IC-471H)	99.95	9.95
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UT-15S UT-15S w/TS-32 installed	96.00	
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IC-47A 25w 440 FM/TTP mic (c/o)	549.00	399.95
PS-45 Compact 8A power supply	145.00	134.95
UT-16/EX-388 Voice synthesizer	34.99	
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IC-28A 25W 2m FM, **TTP** mic	469.00	409.95
IC-28H 45W 2m FM, **TTP** mic	499.00	439.95
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BP-8 800mah/8.4V Nicad Pak - use BC-35	79.00	
BC-35 Drop in desk charger for all batteries	79.00	
BC-16U Wall charger for BP7/BP8	21.25	
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LC-02AT Leather case for Dlx models w/BP-7/8	54.50	
Accessories for IC and IC-O series	Regular	
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BP-3 Extra Std. 250 mah/8.4V Nicad Pak	39.50	
BP-4 Alkaline battery case	16.00	
BP-5 425mah/10.8V Nicad Pak - use BC35	65.00	
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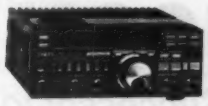

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by Bill Clarke WA4BLC

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ICOM IC-2GAT

Successor to the workhorse 2AT.

ICOM America, Inc.
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206-454-7619
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Over the years many 2 meter HTs have come and gone, yet one has become an accepted workhorse: the ICOM-2A(T). It is a simple, rugged, inexpensive unit that you can rely on to work every time you need it. However, the venerable 2AT is limited to one frequency at a time, thumb wheels for changing that frequency, and no bells and whistles. Enter the IC-2GA(T), ICOM's updated workhorse.

The 2GAT is slightly smaller than its predecessor, yet bears some resemblance to it. Perhaps the most important similarity is that all your old ICOM battery packs will function with the 2GAT. No need to buy extra packs or a new charger when you upgrade within the standard size ICOM HTs (2A/3A/4A, 02AT/03AT/04AT, marine, commercial, and aviation). I appreciate this because I have a box of ICOM batteries and an ICOM charger. They represent an investment that I don't want to replace just for the sake of an equipment upgrade.

No More Thumbwheels

Gone are the famous thumbwheels used for frequency changes. In their place are little rocker switches. They are aligned like the old wheels: MHz/100 kHz/10 kHz. The last rocker (10 kHz) is programmable for step sizes from 5 to 25 kHz. On the top, just above the rocker switches, is an LCD digital display which shows the frequency and various functions. All switching is done from the front or top of the unit; no more looking on the back for switches.

Those of you familiar with ICOM's 02AT series will find the function switch in its familiar location (left side above the PTT switch). The function switch allows many single controls to have more than one function.

The 2GAT isn't a micro-sized radio, but it is not large, either. The automobile makers' phrase "mid-size" seems appropriate for this HT. Its handy size permits controls that are easier to see and use than those found on the micro-size HTs. With the BP-70 standard battery pack attached, I can use my old leather case from the 2AT. This pleases me because the case is hand-made and has my call on it.

Impressions

When I found that I could do simple operations with it even before reading the instruction manual, the 2GAT made an immediate good impression on me. However, for more than just this, reading the manual is required.

The 2GAT has all the HT features considered standard:

- •High power—7 Watts (max).
- •Water resistant—can get damp in the rain (but don't take it swimming).
- •Power saver—reduces battery drain during "no signal" conditions.
- •Two types of scan—program and memory lock-out.
- •Monitor—opens the squelch with the push of a button.
- •Pocket beep—works similar to a pocket pager by using the optional UT-40 Tone Squelch Unit.
- •Battery condition indicator—for battery monitoring.
- •Batteries—available from 270 mAh to 800 mAh (I prefer the smaller size, to keep the physical package small).
- •Extended receiving—covers portions of the public service bands (police, fire, marine, and weather).

Observations

The 2GAT is very comfortable to hold. Although I like the small size of the micro-sized HTs, this new radio allows better physical use of the radio's controls. I did, however, find that the rocker and push switches are very sensitive and that it is easy to make them stutter.

The audio from the 2GAT is adequate for most uses. It is certainly an improvement over the low audio power of the 02AT.

The 2GAT provides a beep whenever a switch is used. The beep can be silenced if desired.

The LCD display can be lighted at the push of a switch. After a few seconds the light will go out, saving valuable battery power.

Programming the memories with my favorite repeaters, NOAA Weather and a couple of local public service frequencies, took a total of ten minutes. Not bad for a first attempt.

I really enjoy the capabilities of this HT's receiver. The ability to monitor local public service, marine, weather, etc. is a nice addition to the standard 2 meter band.

The tuning step-size is selectable. It affects the scanning steps and the size of the up/down jump that the third frequency rocker switch will make. For my uses I found 5 kHz to be adequate for both portions of the 2 meter band and for public service. For the latter, 25 kHz would also work fine.

From time-to-time I operate on a repeater that uses a split of 1300 kHz. This presents no problem for the 2GAT. It accepts anything you program into it.

When using memory scan, you can lock out channels that you don't want to listen to. This is a very handy feature. I use it to lock out heavily-used repeaters when I am listening to the public service band.

Band scanning is programmed by setting the band edges (upper/lower limits) of the planned scan.

As on the 02AT, there is a lock function that effectively shuts off all of the switches. This means that you cannot bump a control and accidentally wander off into never-never land.

The CPU can be reset without opening the

case or having to intrude into the case with a paper clip.

I did not review the UT-40 tone squelch unit, which allows the radio to work like a pager. The idea sounds useful and I plan to make use of it in the future.

Due to the complexity of the 2GAT, I would recommend you practice using its features from time to time. Otherwise, you will find yourself reading the instruction manual each time you want to use the HT. I don't think that this suggestion is very uncommon in today's world of flashy gadgets.

Overall, I gave the 2GAT high marks and recommend it as an affordable, yet complete, 2 meter HT. Its size, weight, capabilities, and transmitter power make it a very desirable package.

"Gone are the famous thumbwheels used for frequency changes."

Bench Check

The 2GAT was bench-checked and found to meet, or exceed, all of the published specifications. As with most recent equipment, this is not spectacular. Only on rare occasions have I found a modern CPU-based communications device that failed to meet specs. Most exceed their published specifications.

Bench checks were made using the following equipment:

- Leader LDC 8243 Frequency Counter
- Marconi Instruments 2022 Signal Generator
- Bird 43 Wattmeter
- Hewlett Packard Spectrum Analyzer
- Cushman CE-5 Monitor

Accessories

ICOM provides a complete line of accessories for the IC-2GAT, including a drop-in charger, assorted battery packs, tone decoder, speaker microphone, headset, VOX unit, and leather carrying cases.

Thanks to the Electronic Equipment Bank, 516 Mill Street, Vienna, Virginia 22180 (1-800-368-3270) for the use of their superb test facility.

Specifications for the IC-2GAT

General Frequency Range	144 to 148 MHz transmit 138.00 to 174.00 MHz receive	Weight	1.1 lbs. (w/BP-70)
		Transmitter output power	7.0 W (high power) 1.0 W (low power)
Mode	FM (F3)		
Memory channels	21 (20 regular & 1 call)	Deviation	+/−5 kHz
Frequency step	5, 10, 15, 20, 25 kHz (selectable)	Spurious radiation	less than −60 dB
Antenna impedance	50Ω	Receiver circuitry	Double conversion superheterodyne
Power requirement	5.5 to 16 VDC	IF	16.9 MHz (1st IF) 455 kHz (2nd IF)
Current drain	Transmit 1.8 A (high power) 0.9 A (low power) Receive 0.25 A (maximum audio) 0.10 A (battery saver)	Sensitivity	less than 0.25 µV (12 dB SINAD)
		Spurious rejection	less than −60 dB
		Audio output	More than 400 mW at 10% distortion into an 8Ω load
Dimensions	2.6" x 5.1" x 1.4" (w/BP-70)		

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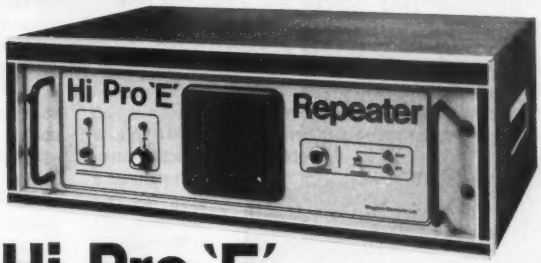

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CIRCLE 47 ON READER SERVICE CARD

73 Review *by Cortland Richmond KA5S*

Shirt Pocket ICF-SW1

How I put the world in my waistcoat for only $300

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In my pocket, briefcase, or even "velcro'd" to the dashboard, the Sony ICF-SW1 is a convenient, powerful all-band radio that should have been available years ago. It is what the ICF-2002 ought to have been. It is certainly hard to resist. I broke down and bought it after just three trips to the radio store. This is a report on my first 60 days using the tiny little set.

The SW1 is small, but the box it comes in is big. That's no deficiency, because the box holds not only the receiver, but also a power supply, earphones, an active antenna, and instruction books. The antenna alone is bigger than the receiver. For top-notch reception, using the active antenna and the AC power supply pulls in even weak stations. For portability, just slide the receiver into a shirt pocket and go. Both the active antenna and the radio are powered by internal batteries, but only the receiver may be run on the AC supply. This shouldn't be a problem. The earphones are (finally) good quality hi-fi "ear-buds" (all these years they sold us expensive radios with two-dollar earplugs) that can produce super sound, especially using the FM stereo mode. It's impressive, even if the earphones do keep falling out of your ears.

There's a soft fabric case for the radio set, but this fails as protection, since it quickly becomes a hassle to use. If you want to use the earphones, you'll find them in their own little reel-in box. It flips open, you unreel the cable and take them out. When finished, pop 'em back in and reel up the cord. No more tangled wires. To step up the audio, a pair of Radio Shack amplified speakers work great in the car, or portable in noisier environments, like the beach.

What about using this setup? Well, it isn't hard to figure out how it runs—Sony has accustomed us to their style with the 2001, 2002, 2003, and 2010. And you can always read the instructions. There's a slide switch for positive "off," so batteries won't be run down by accident. A push-button turns the power on and off: one push and it's on, another and it's off. The audio gain control is conveniently located on the back (if a half-inch-thick set even *has* a back), just where a right-handed person's thumb falls. Mine did, anyway. Tuning is done either with a keypad, or by using up/down buttons for the band and frequencies.

There are really four bands here, even though the SW1 tunes 0.15–30 MHz, as well as 76–108 MHz. First is the long-wave range. The tuning step here is fixed at 3 kHz. It's no problem if your local station isn't right on a step, as the selectivity isn't so narrow as to make this unusable. I have heard several European LW stations on my other equipment but could just barely detect the 2 MW giants with the SW1. Local navigational beacons are readable, but not very. The internal loopstick, after all, is just a few cm long. The active antenna didn't help me much here, either. Still, if I were in Europe, there'd be a multitude of LW broadcasters, all running high power, to fill the band.

The MW broadcast band is next, with either 9 kHz or 10 kHz tuning steps. Europeans use the narrower setting. Again, this is no problem, even if you're DXing, as the set has enough selectivity to be usable, but not so much that it's inconvenient. Performance on MW is somewhat better than on LW, with daytime reception of Boston stations 30 miles north of Beantown, at my work site in the wilds of New Hampshire. Nothing super, but certainly adequate. Strangely, the active antenna was worse than the built-in one.

It's on the SW bands that the SW1 shines. Despite an antenna just about a foot long, it still pulled in the regulars easily. The BBC (5975, 9410, 12095), Israel (7460, 9385, 9435, 15615), AFRTS (6030), Australia (9580)... all came booming in. Iran (9022) was unreadable, though the Iraqi jamming would probably have hashed it up pretty well, anyway. It looks like 2 kHz is a bit too far off frequency for peak performance. Or maybe it's just that I don't understand Farsi.

On SW, the SW1 tunes in 5 kHz steps. That's it. No fine tuning, and no wide or narrow selectivity, either. Well, it does fit in a shirt pocket. Within that limit, if I could hear something on my ICOM IC-735 (with 200-foot half-rhombic and Cushcraft R-3), I could hear it on the SW1. It wouldn't, perhaps, be as strong, or as readable, but I could hear and recognize it. And the active antenna made the SW1 even hotter than the receiver section of the IC-735. That says a lot.

What Sony has done for band selection is to put the bands into permanent memory. By clever use of three buttons at once, you can go up or down through

The Sony ICF-SW1.

the various bands, And they're all there, tropical, 75 meters, 21 meters, and 11 meters. You won't, however, find the 11-meter CB band programmed in. You can tune it and punch in frequencies manually, but you can't jump up to it with the "bandswitch" and you can't scan through it.

The scan feature is one feature Sony did well. Normally, scanning on an SW receiver is a bit of a waste. On the 2010, you can scan the memories, which makes that useful, but the frequency scan has to be set in two memories and doesn't seem to work that well when you do use it. The SW1 seems to have just the right combination of scan rate and selectivity to make it work. If I want to tune the band, I'll let it scan. If there's a strong signal, the radio will stop for a few seconds, then move on. Just enough time, if I'm quick, to stop the scan, but short enough to make it speedy. I don't miss the tuning knob at all. But if I am in a hurry, either the up or down arrows will make the set step right along.

Hear's To You

In a first for Sony SW travel radios, the SW1 has a good-quality earphone. It has even got stereo audio, for FM. But the FM band is disappointing due to the SW1's poor front-end and adjacent channel performance. The FM tuner is plagued by intermodulation from strong stations, even de-sensing when tuned too close to a local FM broadcaster. That's too bad, because the sound is excellent when you get out in the country. The stereo mode is automatically selected if the signal is strong enough. In an automobile, this results in the noise level going up and down unpredictably, which can be annoying. By the way, there isn't any external antenna connection. For the car, I clipped a coax onto the whip antenna's cap and grounded the coax to the "recorder" output jack.

That's how Sony does it, too. The active antenna (which does not cover FM) contains a coax, with a phone-plug on its end. You unreel this cable, but it doesn't plug into the radio. Instead, it goes to a control box. That plugs into the SW-1's recorder output jack. On the control box is an on/off switch, and a bandswitch for LW/MW-SW. How does it work?

The control box is more than that. It has a small ferrite loop, for coupling to the radio on LW and MW. The loop aligns with the internal one when the unit's clipped on. You'd get better reception if you held it against the radio's top edge, but not too much better. On SW, the antenna connects via a spring-loaded button to . . . the built-in whip. Clever. You don't lose the use of the recorder output, by the way, as it's brought through the coupling unit/control box. The on/off switch is nothing more than a DC circuit across the coax, letting current flow to run the remote antenna. If your other portable has DC continuity at its external antenna plug, this antenna will work with it. It did on my ICF-2010. Bear in mind that current will flow as long as it's plugged in, however.

Power drain is not bad, either. I have an ICF-2001 that ate batteries. This set uses two penlight batteries (get them in any drugstore) that last a week or more of heavy use. I haven't run down the antenna batteries—I hardly use it. Still, a trip to the Caribbean or Europe would probably only take one change of cells, and that's great. The 2001 would give me eight hours on three D-size alkalines.

Shortcomings

I didn't say anything about SSB and CW, did I? That's because the SW-1 doesn't have a BFO or a product detector. It's strictly for AM and FM broadcasting. No fine-tuning. Well, I don't know where they'd put it, actually. And without SSB or synchronous detection, who needs it? Most stations are within a kHz of the radio's channel. Actually, the worst shortcoming is the darned keypad. The numbers come off. Sony, why didn't you, when you were selling a $300 radio, at least use double injection molded keycaps? Pretty soon I'll have to paint new numbers on the buttons. And yes, I could have used that pretty little blue-gray fabric cover. But then I couldn't have used the radio like I do. Just whip it out, and . . .

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CIRCLE 349 ON READER SERVICE CARD

Getting High on Packet

Excellent advice for getting on HF packet.

by Brian Lloyd WB6RQN

Most hams operate packet radio on VHF and UHF frequencies, using NBFM radios modulated with Bell 202 compatible modems. Although inefficient, this simple technique allows almost anyone to put a reliable packet radio communications system on the air. The main drawback is that this mode is limited to short-range communications. Many hams may find it far too limiting, and choose HF operation to increase their communications range. However, HF packet operation is not nearly as simple as VHF packet. What are the pitfalls of HF packet operation, and how can you avoid them?

VHF packet uses the Bell 202 modem standard, which means that data is transmitted at 1200 baud, using mark and space tones of 1200 Hz and 2200 Hz, respectively. HF propagation, however, will not support a 1200-baud signaling rate. The current HF operation standard is FSK at 300 baud with a shift of 200 Hz. These operating parameters, and the characteristics of HF operation, create problems for the packeteer.

Packet Trade-Off

Packet radio transmits a Cyclical Redundancy Check (CRC) field at the end of every packet. This CRC allows the receiver to determine whether the packet is correct or whether it has errors. The receiver acknowledges good packets and rejects packets with errors. Even one bit in error will cause the receiver to reject the entire packet. Since there is a probability that a bit will be received in error, this can be a problem.

Let us assume that the rate of bit error is 1e−3 (1 times 10 to the −3 power, or 1 in 1000). This means that approximately one bit in every 1000 bits transmitted will be in error. If our packets are 1000 bits long, most of the packets will have errors. On the other hand, if we shorten our packets to 100 bits, the probability is that only about 10% of the packets will have errors. For this reason, short packets are more likely to be received without errors than long ones.

Unfortunately, you cannot arbitrarily send short packets. Each AX.25 packet contains at least 19 octets (19 eight-bit bytes) of control and formatting information other than the data you are sending. Therefore, you must transmit 152 bits of information in addition to your data. To send even one character (8 bits), you must send a total of 20 characters (160 bits) in the packet. So here we have the big trade-off: smaller packets are more likely to get through, but larger packets are going to give you much better throughput.

> ***"HF packet operation must take place near the MUF for reliable operation."***

In large packets, a greater proportion of the transmitted information is actual user data. Imagine how slow your progress would be if you sent only 20 characters in every packet just to transmit one character of data. You must strike a happy medium. The best value for packet size is a function of your particular station configuration and of the current propagation characteristics. Most HF packeteers seem to find that a packet-length (PACLEN) of 32 octets is a good starting point.

Multipath Propagation and Baud Rate

Propagation plays a very important role in effective HF packet operation. Strong signals, while desirable, are not sufficient to provide reliable communications (kicking in the amplifier is NOT a good solution unless you are trying to overcome QRN). Remember that the receiver discards the packet if even one bit is bad. You must make sure that the receiver can properly discern the bits as they are received.

When you operate well below the Maximum Usable Frequency (MUF), you begin to have problems with multipath, i.e., signals that take different paths and arrive at the receiver at different times. Multipath causes selective fading and "smearing" of the bits. If the signal changes very slowly, the different arrival times do not cause as much of a problem.

To avoid multipath problems, the military chose a 45.45 baud rate for their RTTY operations. A baud rate of 45 will work well from about one-third to one-half of the MUF. In HF packet operation, however, you are using 300 baud, and 300 baud will not work well in the presence of multipath. HF packet operation must take place near the MUF for reliable operation. If you are planning to operate HF packet all the time, you must be able to operate on ALL available bands from 80 meters to 10 meters.

Generating Packet Signals

There are many ways to generate the packet signal. Since packet, like RTTY, is FSK, you can use all the RTTY techniques. Direct FSK, frequency shift keying, is the most desirable technique. Many HF transmitters today offer direct FSK operation, but there is one caveat: most of these FSK modes are optimized for operation at 45 to 75 baud with a shift of 170 Hz.

To operate packet, you will need to adjust the transmitter so that it will generate a 200 Hz shift. You will also need to modify the FSK keying filter (the RTTY equivalent of the CW key click filter), which is a low-pass filter usually found somewhere in the FSK keying line. The standard filter has a cutoff frequency of about 100 Hz, and it will not pass a 300 baud signal. Modify it to a cutoff frequency of 400–600 Hz.

Once you have made the necessary changes, the FSK mode of your transmitter will generate a high quality FSK packet signal. Just take the digital data signal from the TNC ahead of the modem, and use it to

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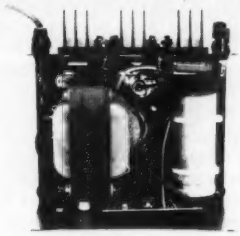

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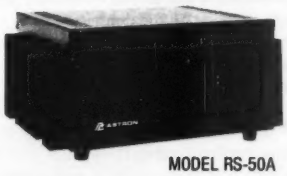

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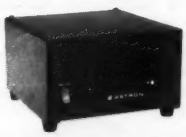
RM-12M	9	12	5¼ × 19 × 8¼	16
RM-35M	25	35	5¼ × 19 × 12½	38
RM-50M	37	50	5¼ × 19 × 12½	50

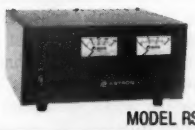
RS-A SERIES



MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4¾ × 5¾	4
RS-4A	3	4	3¾ × 6½ × 9	5
RS-5A	4	5	3½ × 6⅛ × 7¼	7
RS-7A	5	7	3¾ × 6½ × 9	9
RS-7B	5	7	4 × 7½ × 10¾	10
RS-10A	7.5	10	4 × 7½ × 10¾	11
RS-12A	9	12	4½ × 8 × 9	13
RS-12B	9	12	4 × 7½ × 10¾	13
RS-20A	16	20	5 × 9 × 10½	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13¾ × 11	46

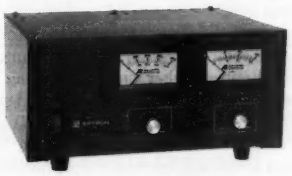
RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
• Switchable volt and Amp meter				
RS-12M	9	12	4½ × 8 × 9	13
• Separate volt and Amp meters				
RS-20M	16	20	5 × 9 × 10½	18
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13¾ × 11	46

VS-M AND VRM-M SERIES



MODEL VS-35M

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MODEL	Continuous Duty (Amps) @13.8VDC	@10VDC	@5VDC	ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
VS-12M	9	5	2	12	4½ × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10½	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13¾ × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5¼ × 19 × 12½	38
VRM-50M	37	22	10	50	5¼ × 19 × 12½	50

RS-S SERIES

MODEL RS-12S

• Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7½ × 10¾	10
RS-10S	7.5	10	4 × 7½ × 10¾	12
RS-12S	9	12	4½ × 8 × 9	13
RS-20S	16	20	5 × 9 × 10½	18

*ICS—Intermittent Communication Service (50% Duty Cycle 5min. on 5 min. off)

CIRCLE 16 ON READER SERVICE CARD

key the FSK line of the transmitter. If the transmitter doesn't accept a TTL level signal at the FSK input, use an appropriate level shifting and/or driver circuit (see the digital section of *The ARRL Handbook* for suggested driver and level shifting circuits).

If your rig does not have an FSK mode, or if you do not wish to adapt its FSK mode to packet operation, you can use AFSK. With AFSK, you feed the tones from the modem into the input of the SSB transmitter. For all purposes, the output is then FSK, or an F1B emission. When you attempt to generate an FSK signal with AFSK and an SSB transmitter, you must be very careful about transmitter linearity, modulating signal purity, carrier suppression, and unwanted sideband suppression.

HF Packet Signal Modulation

The modulating tones you choose are not critical as long as their frequency difference, or shift, is 200 Hz. Most SSB transmitters do not accept all tones equally. If you use a Bell 103 modem to generate the tones (2025 Hz and 2225 Hz), you may have a problem achieving full power output, or the power will differ between the two modulating tones. You can remedy this problem by using modulating tones which are closer to the center of the transmitter's passband. The most common tone-pair used in packet radio is 1600 Hz and 1800 Hz. For most SSB transmitters, these frequencies fall in the middle of the passband, where the the passband is flattest and the distortion is least. You can adjust most TAPR TNCs and their clones to generate these tones.

When you are using AFSK, the frequency display on the transmitter will not be accurate. Most RTTY and packet operation is lower sideband (LSB), which causes the transmitted signal to be lower than the transmitter's displayed frequency. To determine the actual transmit frequencies, you will have to add or subtract the tone frequencies from the transceiver's carrier. If you are using the standard 1600/1800 Hz modulating tones, and the transmitter is configured for LSB at 14108 kHz, your signals will end up on 14106.4 and 14106.2 kHz, respectively.

Remember that most HF transmitters are not rated for continuous operation at full power. If your transmitter is not rated for 100% duty cycle at full output, keep a close watch on the temperature in the PA. Although packet is not a continuous-operation mode, it can tax the average transmitter that is not rated for 100% duty cycle operation. Play it safe. Limit your transmitter to about half of its maximum rated power output for packet operation.

HF Packet Reception

HF packet receiving techniques are almost identical to HF RTTY receiving techniques. In almost all cases, an SSB receiver feeds audio frequency signals into a demodulator (terminal unit, or TU, in RTTY parlance). The demodulator identifies and extracts the bits for presentation to the digital circuitry of the TNC.

The first step toward achieving the best performance from your HF packet station is to pay attention to the radio part of packet radio. Simply attaching a TNC to an HF receiver, switching on LSB, and trying to copy packets, is likely to produce disappointing results. The first problem stems from the fact that most SSB receiving filters are far too wide, typically 2.1 to 2.5 kHz in bandwidth, for packet operation. Unwanted signals come into the passband and activate the receiver's AGC. Although your ear may not discern the change, your modem and TNC will. Most experienced HF packeteers have found that a 500 Hz CW filter is just about optimum for 300-baud HF packet with a 200 Hz shift.

It is very important to ensure that you get the tones in the center of the filter's passband. Most modern receivers have some sort of passband tuning (PBT) control that allows you to shift the filter relative to the BFO injection frequency. Use the PBT to center the tones in the filter's passband. If your receiver does not have a PBT control, you must tune the receiver to center the tones in the filter's passband, and adjust or modify the demodulator to accept the final tones.

"Most experienced HF packeteers have found that a 500 Hz CW filter is just about optimum for 300-baud HF packet with a 200 Hz shift."

You must have a tuning indicator that will allow you to tune the receiver EXACTLY. If you want your demodulator to work properly, you will need to tune the receiver to within 10–20 Hz of the transmitted signal. The performance of most demodulators falls off very rapidly as the receiver is detuned, so the receiver's stability in maintaining a frequency is very important.

With the proper filter in the receiver, and a properly tuned receiver, almost any demodulator will produce good results. Several manufacturers offer high performance demodulators that give better results than the simple demodulators provided with most TNCs. On the other hand, if you do not bother to tune carefully, and if you do not have a good 500 Hz filter, even a "super demodulator" is likely to perform more poorly than an inexpensive demodulator. Spend the money on the receiver first, then decide whether you need a super demodulator.

Operating Suggestions

HF packet is not easy to tune in. For this reason, many stations tend to congregate on just a few frequencies, and not everyone can hear everyone else. This causes Carrier Sense Multiple Access (CSMA) to break down, to everyone's detriment. Here are a couple of operating suggestions:

1. Don't try to access the long-haul bulletin boards. If you want to access a BBS, do it on VHF. Use HF packet for rag-chewing or exchanging data with your more distant friends. If there are no BBSs on VHF near you, access only those HF BBSs intended for user access.

2. If you wish to call CQ, call on one of the regular HF packet frequencies, then QSY to a different frequency. This will prevent you from interfering with each other. Before you QSY, decide which station will send a string of long packets to aid the other station in tuning.

3. Don't beacon on the calling frequencies. This will mark you as a lid. A few CQ packets are fine as long as you don't overdo it.

4. Do not operate HF packet unattended. Unattended packet operation is legal only above 50 MHz.

Going a Step or Two Further

Now you're running HF packet. You have a superb FSK transmitter, a super-stable receiver with the perfect 500 Hz filter, and the best demodulator money can buy. Is there anything else you can do to make it better? The answer is yes.

First, you can increase the shift. This will give you more immunity from selective fading, and less intersymbol interference from multipath. However, when you increase the shift, you must also increase the receiver's bandwidth to cover the new shift, plus approximately half the baud rate. For example, for a 400 Hz shift at 300 baud, you need about 550 Hz of bandwidth.

Increasing the bandwidth opens the window for more interference. If you have a demodulator with good filters and a wide dynamic range, and the QSB is not bad, try operating with the AGC turned off. Again, you must accept a trade-off, but the results may be worth it.

You can also try space diversity reception. Unfortunately, space diversity requires two antennas, two receivers, and a demodulator with a circuit that can automatically choose between the two signals. Space diversity is probably the best weapon against multipath distortion. (There is a third technique, frequency diversity, that requires only one receiver, but the sender must send the same signal on two different frequencies. This approach is not unacceptable for amateur radio.)

Real improvement in HF packet radio will come from two sources: better modems and forward error correction. Better modems will probably offer higher baud rates, along with improved resistance to multipath and interference. Forward error correction will allow the receiver to correct most bit errors in the packet so that the transmitter does not have to send the packet again.

Ready for HF?

For easy operation, use direct FSK, get a narrow filter in the receiver, tune carefully, and be polite. If you take extra care in setting up and operating, your HF packet station will pay for itself many times over. 73

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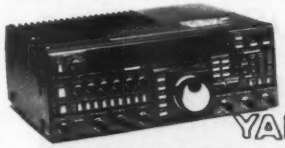

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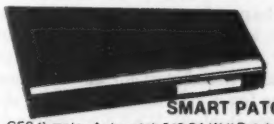

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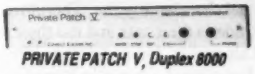

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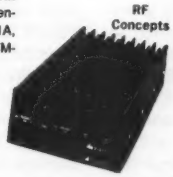

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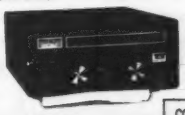

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CIRCLE 41 ON READER SERVICE CARD

Simple CW IDer

Automatic operation for repeater or fox . . .

by Glenn M. Cascino WNØEHE

For the past few years I've been involved with a 2 meter foxhunting group. Customarily, the winner of the hunt becomes the fox (hidden transmitter) for the next hunt. Being the fox is a lot of fun, but it can also cause some problems. What does one say for two hours straight? What type of transmitter should be used? Usually an HT is not suitable as a hidden transmitter, because of its low power and short battery life. Therefore, most people hide in their cars and use their mobile rigs. This makes for some very interesting hunts. But what if a portable transmitter was available that could run continuously and unattended for portable operation?

In a surplus electronics store, I found an old solid state Genave transmitter that was set up for data telemetry operation on the 150 MHz band. After being the fox a couple of times and running my five-hundred-dollar Yaesu dual-bander almost continuously, I found a use for that old telemetry transmitter. It did not have a microphone preamp since it was originally used for telemetry. Rather than build a preamp for it, I built a CW IDer. This solved the problem of what to say while hiding, and allowed unattended operation in a small portable and very "hideable" package.

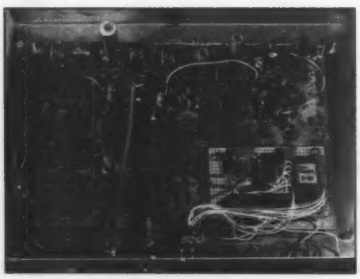

Photo A. Inside of the hidden transmitter. CW Identifier board is in lower right of the photo.

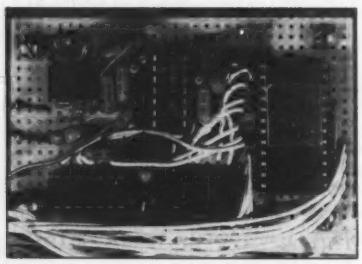

Photo B. CW hidden transmitter identifier.

Photo C. Hidden transmitter in enclosure with heat sink for continuous duty operation.

The CW Identifier

Several members of the foxhunting group might use the portable hidden transmitter, so it should have several call letters available on the CW identifier. I built the identifier with TTL LS logic circuits. I used a dual 555 timer for CW rate and a 1 kHz audio oscillator (see Figure 1). The design is based on a 2716 EPROM (Erasable Programmable Read-Only Memory). One half of the 556 feeds two 7493 ripple counters (or one 74393), giving a binary output counting from ØØ Hex to FF Hex, or 256 counts. The eight outputs from the ripple counter are connected to the address lines AØ to A7 on the 2716. A8, A9, and A10 are not used so they are tied to ground. The ripple counter steps the 2716 through the first 256 addresses and continues to loop indefinitely.

In this application, the eight data lines on the 2716 are analogous to an 8-track magnetic tape, where all eight tracks are parallel to each other. Only one "track" or data line is read at a time. This allows you to program eight different CW calls or messages into the PROM. For our foxhunting, we programmed eight callsigns followed by "hidden transmitter." We used a ten-position rotary switch to select one of the eight data lines, one position for continuous tone, and the other position for no tone. The selected data line is connected through the rotary switch to pin 4 of the 556, enabling the 1 kHz audio oscillator. R6 and C5 filter the square wave from the 556 using a first order low-pass with a corner frequency

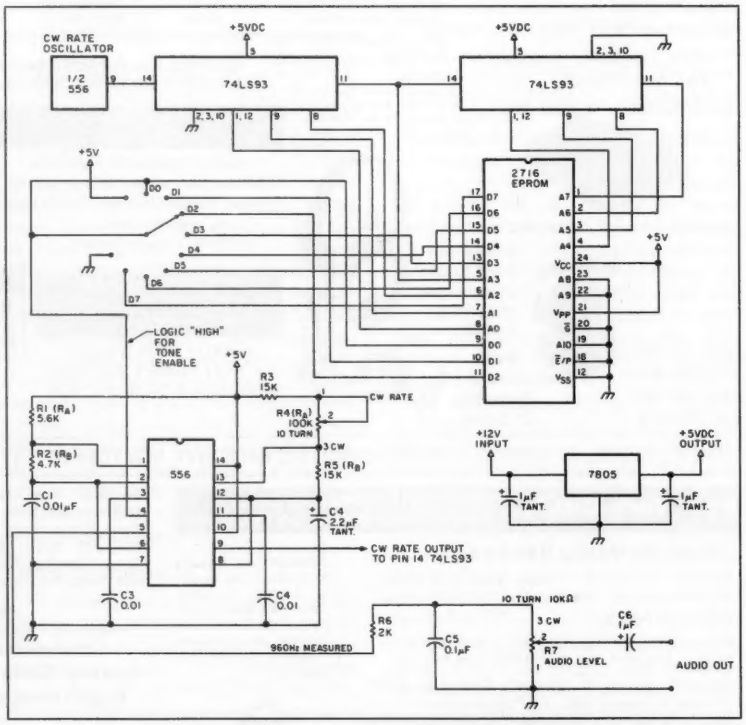

Figure 1. Hidden transmitter CW identifier schematic diagram.

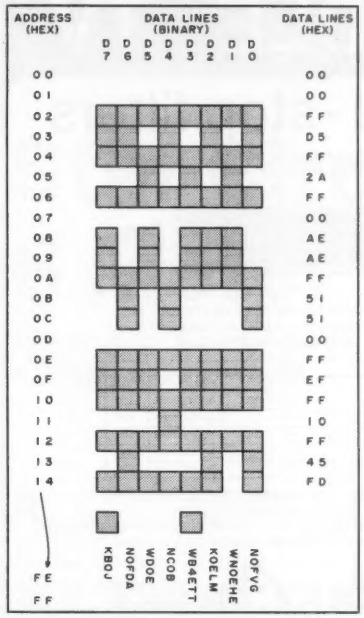

Figure 2. An example of how to derive data words for PROM programming. (Only the first 14 address locations are shown.)

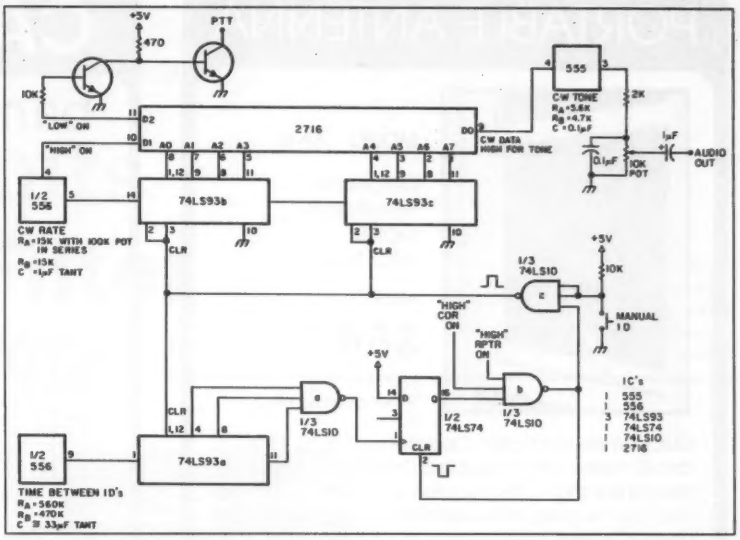

Figure 3. Repeater identifier schematic diagram.

of 800 Hz, providing an audio output closer to a sine wave. R4 allows adjustment of the CW rate and R7 provides a wide range of audio output. The 7805 voltage regulator provides +5 volts to power all circuitry. The completed hidden transmitter with CW IDer is shown in Photo A.

The transmitter has been heat-sinked for continuous duty operation at a rated power of 10 Watts. One knob near the SO-239 connector allows for continuous power selection from 200 mW to 10 Watts (transmitter modification by WB4ETT and NØFVG). The other knob selects one of the eight programmed CW call letters. A terminal strip lets you connect a battery, with external PTT and audio, if desired.

Programming the PROM

You should set up a list (as in Figure 2) to program the PROM. Enter the message for each data line vertically, using one location for a dot and three locations for a dash. After you have entered all messages, you can calculate the hexadecimal value for each address. Then you can program the first 256 addresses of the 2716 using any type of PROM programmer.

A Repeater Identifier

With additional circuitry, you can make a repeater identifier (see Figure 3). You use one data line (DØ) for CW data information, again gating the audio oscillator. You can use the other data lines for control functions. D1 enables the CW rate oscillator when an ID is in progress. D2 keys the repeater transmitter. TTL logic inputs are provided for "COR present" and "repeater on."

Circuit Operation

One half of the 556 timer provides clock pulses to the 7493(A) and the 7410(a). In ten minutes the D flip-flop (7474) is clocked, causing Q to go high. If the repeater is on and COR is present, the output of the 7410(b) goes low, resetting Q to a low state and providing a high pulse output from 7410(c). This clears all ripple counters and starts the ID sequence.

When the ID is completed, D1 goes low to prevent further clocking of the 2716. All circuitry remains in this state until another ten minutes passes and the D flip-flop is set again. If Q is set, it remains set until the "repeater on" and "COR present" lines are both high, at which time the ID sequence is again initiated. 73

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73 Review by Mike Baker W8CM

Star Circuits 6 Meter Filter

No more TVI from 6-meter signals.

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Anyone who operates 6 meters usually finds that his first award is WANTS, for "Worked All Nearby Television Sets." Even low-power 6 meter operation can make your neighbors take amazing notice of you. I run kilowatts on 1.8 through 432 MHz, but my neighbors only notice I'm on the air when I'm running 50 Watts on 6 meters!

Hams looking for RFI filters for 6 meters become frustrated. TV high-pass filters generally attenuate the HF bands, but they let 6 meter signals through because it is adjacent to Channel 2. Generally, optimized low-cost filters have not been available for the 6 meter band. A 6 meter filter had to be home-brewed from a piece of coax or twin lead as a stub filter. These stubs were difficult to tune (after cutting off too much, just try putting a quarter-inch back on!), bulky, and only marginally effective. Also, since no one makes a type "F" T-connector for coax, you had to roll your own by modifying a splitter assembly.

A 6 Meter Filter at Last!

A new filter from Star Circuits may go down in 6 meter annals as the best thing to come along since sliced bread. This filter will be welcomed by active 6 meter operators and those who are staying out of the fun for fear of RFI. Star Circuits designed this filter, the 23-H, as a cousin to their existing line of cable TV filters. At my suggestion, Fred Kurtz, owner of Star Circuits, agreed to build a prototype filter for testing. Three cheers for Fred! Though not a ham, he was willing to listen to my entreaties.

Photo A. Star Circuits' 6 meter filter.

Installing the Filter

Installation of the 23-H turned out to be simple. The filter has standard type "F" fittings and can simply be placed in the antenna coax. You can mount the filter directly at the back of the TV set or VCR with a standard "barrel" male/male adapter (available from Star Circuits for 50¢ or at any Radio Shack for $1.69).

Operation

The filter is a band-reject device that tunes the entire 6 meter band with a notch attenuation of up to 37 dB (see Figure 1).

The 23-H filter comes with easily set adjustments for both the notch frequency center and bandwidth. I set the test filter for maximum notch depth and minimum bandwidth at 50.150 MHz. The filter's passband nicely covered the normal SSB portion of the 6 meter band. Additional attenuation or other notches could be obtained by inserting the filters in series and tuning for desired effect. The insertion loss of one filter was measured at 2.2 dB, so the effect on the TV picture is negligible.

Conclusion

No device alone will ever be a cure-all for 6 meter RFI, and this filter will not solve problems caused by power line pickup or audio rectification. Regardless, Star Circuits' 23-H filter does give the 6 meter operator a valuable weapon against RFI that comes in on the antenna coax line.

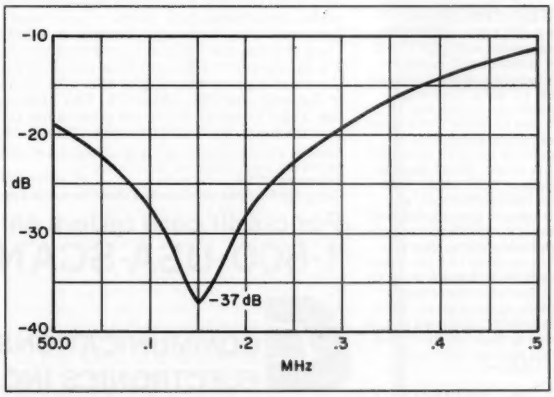

Figure 1. 50–50.5 MHz attenuation curve for Star Circuits' 6 meter filter, part number 23-H.

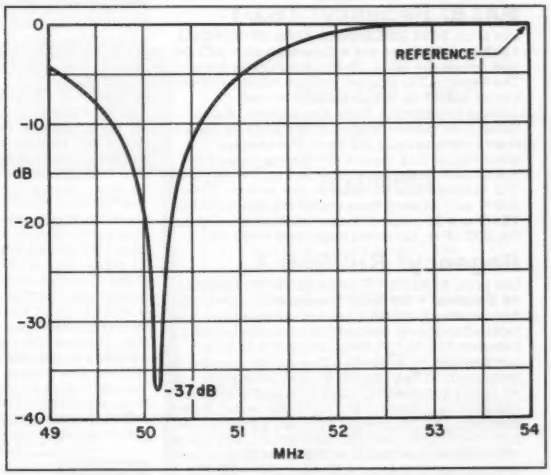

Figure 2. 49–54 MHz attenuation curve for the 6 meter filter, part number 23-H.

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Bands: 29-54, 118-174, 406-512, 806-912 MHz.
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10-Band, 16 Channel • No-crystal scanner Priority control • Weather search • AC/DC
Bands: 29-54, 136-174, 406-512 MHz.
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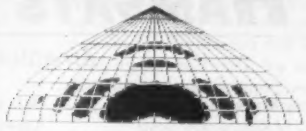

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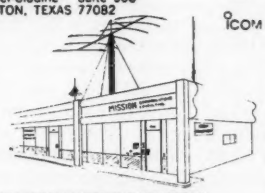

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AMSAT GENERAL MEETING

Space Symposium 1988

AMSAT is moving forward. During the 1987 meeting in Detroit, the organization emphasized two goals: In the near future there will be some sort of PACSAT or digital satellite compatible with packet radio, and the long-term focus will be on Phase 4 geostationary satellite development.

While design and engineering of Phase 4 continues at a measured pace, the packet satellite project has exploded with activity. Although there has been some controversy, the designers and builders are in the last stages of putting the first four Microsats in orbit. Instead of a simple mockup, a real flight model was on display at the AMSAT General Meeting and Space Symposium in Atlanta last November. Except for the "Do Not Touch" signs, this small package, just nine inches on a side, was right there for all to see. For the '90s, AMSAT continues pursuing Phase 4, but the next two years will be dominated by Microsats.

An Exciting Interruption

Saturday morning, just after AMSAT Executive Vice President John Champa K8OCL had completed the official welcome and introductions, a few hams were seen setting up a type of VHF station in the parking lot in front of the Atlanta Airport Marriott Hotel. Leonid Labutin UA3CR was with them. Leo had been invited to previous AMSAT meetings, but this was the first time he had made it to the U.S. He reported that, just four days earlier, a contact had been made between U2MIR, onboard the Mir Space Station, and UK3KP in Moscow. Now it appeared that these hams were going to attempt a contact from the hotel parking lot to the orbiting Mir.

We were not disappointed. At 1540 UTC, Saturday November 12, Byron Lindsey W4BIW, AMSAT Convention Chairman, had the honor of making the first U.S. to Mir amateur radio contact on an undisclosed 2 meter frequency. Byron's "earth station" used an ICOM IC-2AT with a 30-Watt amplifier and a dipole antenna aimed by *Satellite Experimenter's Handbook* author Martin Davidoff K2UBC. Although signals were very weak on this short pass, later contacts with Vladimir Titov U1MIR, Musa Marinov U2MIR, and the onboard doctor U3MIR were much better.

Any satellite operator can work the Mir space station. Although many contacts have been made on the direct frequency of 145.55 MHz, the official uplinks are 145.525 and 145.575 MHz. The downlink is 145.55 MHz. According to Leo UA3CR, the rig used by the cosmonauts for the early contacts was a Yaesu portable model purchased in the U.S. by UA6HZ. It was allegedly sent into space in a box that was supposed to be carrying a cake. The Mir ham antenna is a simple quarter-wave whip mounted externally. A 10-Watt 2 meter rig built by hams in the Soviet Union and Hungary is to be sent up later. As with American efforts to put ham radio into space, the Soviet proposals for the same have been denied until recently.

Photo A. Several hams look on as preparations are made for the first US to Mir Space Station amateur radio contact.

Photo B. Leonid Labutin UA3CR discusses Soviet packet radio operation from space over a microsat.

Accurate tracking information for Mir is hard to find. Although NASA provides Keplerian element sets from the Goddard Space Flight Center to those requesting them, by the time hams receive them via mail, they may be seriously outdated. Mir is in a very low orbit. The decay rate is significant and the cosmonauts frequently use thrusters to maintain orbit. Although this may sound like something from Star Trek, it is a very real situation caused by atmospheric drag. Our own Skylab succumbed to drag and re-entered several years ago. Hamsats users can find reasonably correct tracking data for Mir via the AMSAT 20 and 75 meter nets.

W5LFL, WØORE and DPØSL were the first calls heard from space. We have now heard U1MIR, U2MIR, and U3MIR. Several more "MIR" callsigns are expected as more cosmonauts are authorized for ham activity via the Soviet space program. Upcoming projects may also include packet radio from Mir. Space-ready TNCs are already on the workbench in Moscow.

Back to the Symposium

Even without the excitement of such a historic moment as the *Mir*-U.S. ham contact, the Space Symposium would have ranked with the best. The Atlanta AMSAT group worked with the Atlanta Amateur Radio Club to make arrangements and coordinate the event. This was the second year for a parallel session of talks. There was not enough time in the weekend for all of the papers to be presented sequentially. The satellite enthusiast faced serious choices due to the many fascinating topics covered concurrently.

Programs on Saturday began with AMSAT Vice President of Operations Courtney Duncan and his presentation on the future of the amateur satellite program's control station operation. When the first set of microsats are launched, controllers will be needed to maintain satellite operating schedules and monitor vital signs.

Stan Sjol WØKP followed Courtney with an update on progress made at Weber State College in Ogden, Utah, toward the microsat and Phase 4 projects. Weber State was responsible for the NUSAT-1 satellite launched from the shuttle cargo bay a few years ago.

Other early morning papers included one by W4ITJ on satellite orbital characteristics prior to atmospheric re-entry and another by JM1MCF, JR1SWB, and JK1VXJ dealing with multi-microsat data transfer management. Although the microsats are not yet in orbit, discussions and studies are already underway to determine efficient use of the resource of inter-satellite communications.

AMSAT directors Dr. Tom Clark W3IWI and Dr. Bob McGwier N4HY teamed with Lyle Johnson WA7GXD of TAPR (Tucson Amateur Packet Radio Corporation) to present progress on AMSAT's Microsat/Pacsat program, the DSP (Digital Signal Processing) project, and the joint efforts of

AMSAT and TAPR to finalize hardware for amateur use.

Capping the morning was a field organizational meeting hosted by Doug Loughmiller KO5I; the microwave beacon system of Charles Osborne WD4MBK; RS-11 ionospheric experiments by KT7D, KV7B, and Jeff Schoen; and notes on the proposed American space station ham radio activities by Ed Stluka W4QAU.

Saturday afternoon was packed with more exciting talks. ZS6AKV described BACAR (Balloon Carrying Amateur Radio) efforts in South Africa while N4HY, WA7GXD, and NØADI continued with microsat and PACSAT software and hardware descriptions.

AMSAT Vice President of Engineering and Board of Directors Chairman Jan King W3GEY gave an update on AMSAT-OSCAR-13. Dick Jansson WD4FAB presented a mechanical engineering status report on the AMSAT Phase 4 project complete with drawings and descriptions.

Other talks in the afternoon sessions included a Skitrek wrap-up report, the future of the Japanese amateur radio program, and a mission profile of the NOAA-H weather satellite.

No one could possibly attend every talk or absorb all of the material. In recent years AMSAT has recognized this problem and has published copies of the proceedings. 1988 was no exception. A copy can be purchased from AMSAT-NA for $12. Call 301-589-6062 or write to AMSAT, P.O. Box 27, Washington, DC 20044. AMSAT members may also rent copies of the videotapes that were made of all talks at the Space Symposium.

The symposium was followed by a banquet with keynote speaker Geoffrey Perry of the Kettering Group. Known worldwide for their incredible ability to decipher Eastern Bloc satellite telemetry, the group's methods appear as a mix of intuition and black magic. Tenacious perseverance and insight have allowed this group of mostly high-school students to decode encrypted signals from Chinese and Soviet satellites using only simple equipment.

Leo UA3CR followed Geoffrey with updates on Soviet hamsat projects and the possibility of a joint Soviet-American Antarctic Skitrek. Outstanding AMSAT volunteers were recognized, prize drawings were held, and speeches were made by the AMSAT officers.

If Saturday wasn't long enough, those wishing more stayed for the Board of Director's meeting on Sunday and Monday. Changes were made to the AMSAT publications, a new set of bylaws were approved, and Leo became UA3CR/W4. On Sunday morning, he passed his Novice and by dinner he had passed all the requirements necessary for a U.S. Extra-class license.

Times are changing and AMSAT truly is moving with them.

A-O-13 operating schedule up to March 15, 1989:

Mode B	from MA 3 until MA 100
Mode JL	from MA 101 until MA 150
Mode B	from MA 151 until MA 240
OFF	from MA 241 until MA 2

A-O-13 operating schedule from March 16 until May 3, 1989:

Mode B	from MA 100 until MA 150
Mode JL	from MA 151 until MA 210
Mode B	from MA 211 until MA 0
OFF	from MA 0 until MA 100

Table 1. Early 1989 A-O-13 schedules. MA (Mean Anomaly) defines the satellite's orbital position where MA 128 is apogee and MA 0 or 256 is the perigee.

Updates

RS-10/11 continues with Mode A (2 meters up and 10 down) seven days a week. On weekdays, Mode K (15 meters up and 10 down) and Mode A may be activated simultaneously. Mode T (15 meters up and 2 down) will not be activated due to interference problems with the main payload. RS-10 is still operational but will only be activated if something goes wrong with RS-11.

Fuji-OSCAR-12 was available in December for limited periods. The declining batteries and poor power budget have weighed heavily on this satellite. JAS-1B is reported to have 50 percent more power, improved antennas, and sun-sensor. No launch has yet been identified. Check the AMSAT bulletins for current information.

Check The Polarization

Many have compared operation via AMSAT-OSCAR-10 and AMSAT-OSCAR-13. A few even decided that A-O-10 works better than A-O-13. There are reasons for this. First, if a station listens to A-O-13 while the satellite's directional antennas are aimed more than 40 degrees off, signals will be weak. A-O-10 transmits on its omni antenna, so pointing angle is not as critical. Many stations are using linear downlink antennas or circular polarization antennas that are set for left-hand circular rather than right-hand circular (favored by A-O-13). My own KLM-14C was wired for LHCP. To go to RHCP the relay must be energized. Check your system and operate around times when Mode S (70 cm up and 13 cm down) is activated. The ground-control stations command Mode S "ON" whenever pointing angles are best (usually around apogee, the orbit's high point) since satellite off-pointing is most critical then. When A-O-13 favors your location, signals will be fantastic. During the best times, reports of reception using only simple whips are common.

Photo C. Ready for launch, an AMSAT NA microsat was on display at the space symposium. It will be launched into a polar orbit via an Ariane rocket.

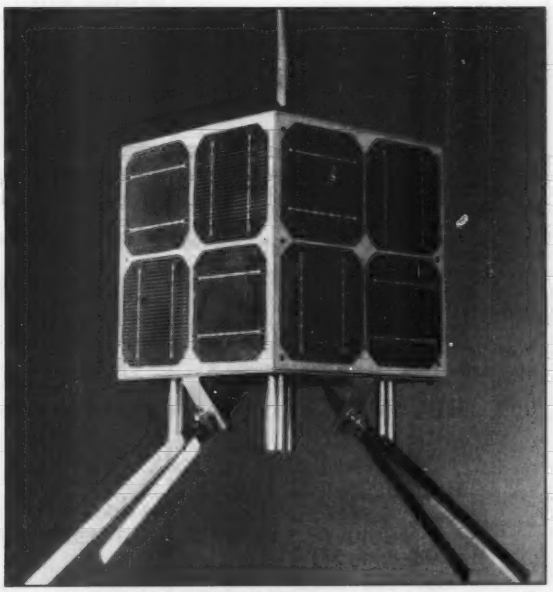

Photo D. Scale model of ITAMSAT from AMSAT Italy. Italy's first satellite may be launched within a year.

LETTERS

From the Hamshack

The Vote's In On 73s And 88s!

Yes, I vote against Best Regardses and Hugs and Kisses or 73s and 88s.

I know that some use it as a matter of convention. Most hams that go back 20, even 10 years, still believe in clean signals, proper procedures, and the old-fashioned ethics of amateur radio.

I personally don't feel that it is possible to ever return to pride of self, accomplishment, and being a good operator, and a technically-informed operator. We are stuck with what we have become. At least the FCC has enough sense to start reassigning frequency assignments to the commercial people (i.e. 220 MHz).

Joe Feagans
Tallula, IL

Joe, thanks for taking the time and effort to send your comments.

Your opening comments clearly refer to the vote set up in the September issue by the then-Editor-in-Chief Larry Ledlow, Jr. NA5E. Larry called for this vote as a result of a letter sent to us by Brent NW0T ("Letters" September 1988). In that letter, Brent claimed that "73s" and "88s," defined in December 1987 73 "Welcome Newcomers," are incorrect, because the plural meaning was already incorporated in the numbers. Evidently, NA5E, as well as myself, had learned the convention—right or wrong—of putting the "s" on the end of 73 and 88, as he then had final say on all editorial material.

The final tally:

Against the use of the "s" 2
For the use of the "s" 2
"Who really cares?" 5

Thanks to all who participated in this vote!. . . NS1B

Who Cares?

I wonder sometimes if people like NW0T have anything better to do in life than try and impress others on how gracious their English and knowledge of the Amateur Radio rules are.

I like saying 73s and sometimes I like saying 88s, but to have someone tell me that just because I talk with a little twang, I have to change? Tell Brent to take a hike and impress someone else, as he only goes to show you that being a HAM takes all kinds. Elmer, his teacher, as well as others have to change with the times and accept the new words and new slangs that come about!

The world is changing, Brent, hope you do too! **Frank N9GQR**

'Nuff said!

Not Another Noah!

I recently coined a new term and definition in ham radio, and thought I would submit it to *73* to share with the rest of the world.

R-I-G-A-M-O-R-T-U-S—"That state in ham radio in which your finals smell like burnt shoe leather, making your key good for only cracking walnuts."

Francis Dohanich WB5PUB
Austin TX

Thanks a lot there, Francis, we think.

Really, Really Rad

Damn, you write provocative and informative editorials.

Thank you for the lengthy and thought-demanding work in the November issue. I respect those who "never say die" and live their lives in harmony to that philosophy. The more of your editorials I read the less radical you seem . . . or is it the more radical I seem. Whatever, I can see the power of your pen and appreciate it.

It is most difficult to appeal to the good judgment of a bureaucracy such as the ARRL without getting the feeling you have violated the sanctity of ham radio, and proud tradition. Just as it is tradition that chokes the life out of most denominations and their applications in Scripture, likewise it is tradition that is choking the life from ham radio. We have no Pope or final authority above us, so we have turned our own destiny over to the tyranny of tradition. If we ain't done it (sic) that way previously, it must be wrong.

You have helped me get a grip on this destructive and pervasive attitude, and I commit myself to seeking new ways to advance my hobby. **Doug Strange**
Comanche OK

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ATV

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Advancing the State of the Art

73 Magazine is taking a more technically-oriented tack now, and so shall the ATV column! For the past two years, many of you have followed this column each month to enhance your knowledge of fast and slow scan TV operation. Many of you have also bought or built your own ham TV gear, and now you're on the air, sending live black and white, or even color, amateur TV pictures across town or within the county. Some of you have become really serious about ATV DXing, even out of state. Great going!

Stay with us in 1989, and we'll take you even further into the mystical world of the video waveform. In future columns, we will cover easy-to-build receive downconverters, transmitters, synch signal-stretchers, antennas, preamplifiers, bandpass filters, simple video switchers, and much more. We'll look in depth at computer programs designed for ATV graphic applications, and explain how to mix SSTV, FAX, RTTY, packet radio and other modes with FSTV. We'll compare AM and FM TV signals based on the results of studies, and explore ham TV on the 900, 1200, and 2300 MHz bands.

I've received many letters asking about how to form an ATV club, write a constitution, and build a group ATV repeater or remote transmitter. Keep those cards and letters coming. We'll cover these and other facets of ham TV in coming ATV columns.

AEA Unveils New Fast Scan Rig

Those active in fast scan TV are well aware that Advanced Electronics Applications has added a new UHF ham TV transmitter to their line of amateur specialty equipment. The FSTV-430 ATV rig was unveiled late last year. The introduction of AEA into the ATV marketplace shows one major manufacturer's belief in a yet-to-be exploited visual mode of communications. Other manufacturers are rumored to be close behind. At the Dayton Hamvention last year, several manufacturers were asking hams, "Do you own a camera or a VCR?" Getting major manufacturers involved in the ham TV marketplace, which has yet to peak, would boost all aspects of FSTV activity everywhere. For a comparison of the three most popular 1-watt ATV transceivers on the amateur market today, see Table 1. The results were based on rigs tested locally by the BRATS ATV Club in Iowa.

To decide which ATV transceiver is right for you, study the features that attract you the most. Ask other hams in your local ATV group what they are running. Wyman Research and PC Electronics also offer partial kits.

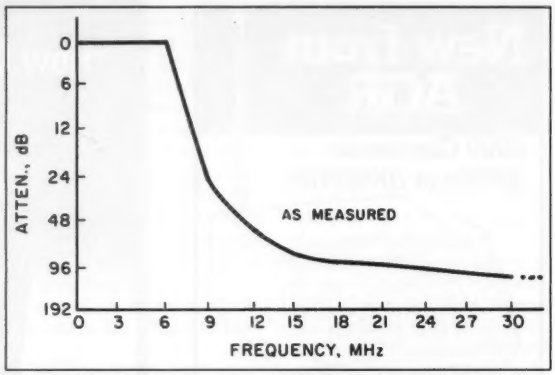

Figure 2. Chart of attenuation vs. frequency for the 7-pole filter.

70 Cm Alert

In most parts of the country, there is still plenty of room for wideband television transmissions on UHF in the 70 cm band. In other parts, hams are moving into the 900 and 1200 MHz region. A QRM-free verbal battle is raging to keep ATV mode operations on the 420–440 MHz, or 70 cm band. Loss of the 70 cm band for ATV operation would be a disaster. An estimated eighty-five percent of hams now on the 70 cm FSTV band in the US, doubt whether they would continue operating ham TV on higher bands. I feel it's worth fighting for. Others may disagree, but the important thing is for motivated hams to build or buy some equipment, and start having some of the FUN that the rest of us are enjoying!

ATV Workbench Projects

Many fast scanners continue to build their own equipment. Merle Reynolds W9DNT in Illinois, Gerald Cromer K4NHN of South Carolina, "Captain Video" Ron Cohen K3ZKO of Pennsylvania, Dave Williams WBØZJP of Missouri, Mel Dunbrack W1BHD of Massachusetts, Robert Jett W7KPW of Texas, Don Miller W9NTP of Indiana, and many others have built some of the neatest looking gear for ham TV I've ever seen.

The Line Sampler and 7-Pole Filter

Here are a couple of easy-to-build projects for the ATVer, to take your mind off of shoveling snow or worrying about whether your XYL left your car lights on at the grocery store. The Transmission Line Sampler was sent to me by Bill Parker W8DMR, Mr. ATV of The ATCO Ohio ATV Group (see Figure 1). W8DMR writes: "Sampling the RF field flowing in a transmission line is fairly easy. It is just a matter of inserting a short

Continued on page 73

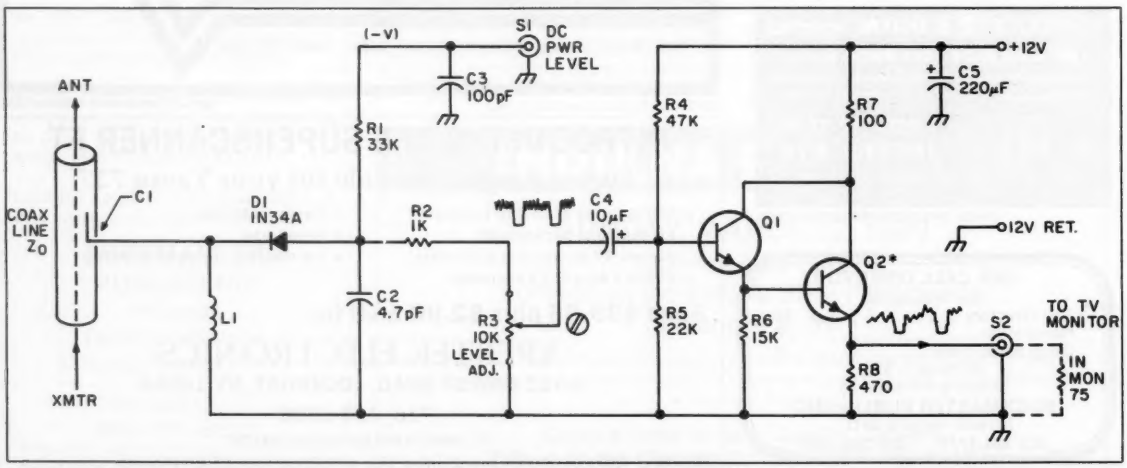

Figure 1. Schematic diagram of the Line Sampler

Never Say Die

Continued from p. 8

solutions I've suggested are interrelated. For instance, by solving our problem of the gradual death of amateur radio, we also will automatically be providing our country with the engineers, technicians, and scientists it needs to regain its electronic superiority. The Japanese electronics industry is at the heart of their rise to power—the engine driving their whole economy.

We're all well aware that the world is becoming more technical—that technology is the key to the future. But the question is, what can we do about it? We've destroyed the 5000-school radio club infrastructure which brought 80% of our Novices up until Incentive Licensing wiped 'em out in 1964. I proposed a simple way around that problem—via a self-teaching eight-year course for all children in grades 5–12 in the fundamentals of electronics, communications, and computers.

The self/peer-teaching aspect is to get around the lack of teachers. It would take at least ten years and millions of dollars just to build a supply of science teachers. We haven't got those ten years to spare—or the millions.

Since there seemed to be an interest in reducing the national debt, I proposed a way to cut billions in government and military waste. I suggested an inexpensive way to end the war on drugs, thus cutting crime by about 75% and contributing toward a solution to our education problems. I proposed an inexpensive solution to welfare and the homeless. Just think of the money we'd save if we weren't fighting an ever escalating war on drugs, supporting millions of welfare families, and living with incredible waste in government!

I believe the American educational system can be made productive and brought back to #1 in the world—and without throwing billions of dollars at the problem to do it. All of my solutions are designed to be primarily self-funding, depending more on entrepreneurs than the government. And I do have a Ph.D. in Entrepreneurial Science, if you need that reassurance.

Now, I can't do all of this alone. I need your help. I don't think there are any amateurs who really want amateur radio to be lost—yet that's the way things are going right now. If you can help me get my fundamental electronics course started in grade schools, we'll not only get amateur radio growing again, but we'll also be developing the engineers we're going to need in the next century. The kids who are in the 5th grade now will be the college graduates of 2000, so we'd better get 'em interested in technology right now. Or else.

How can you help? I'll be writing about that. I need your help in many ways. I need it at the federal level to help get the government behind a move to bring electronics courses into our grade schools. The decisions on this, though influenced by the federal government, are made by the states, so I'm going to need help with state governments.

You can also help with your own children and grandchildren—and I'll be writing about that. You can help in your community by working with your local schools to start radio clubs so we can rebuild our lost infrastructure.

You can work with your local radio club to make amateur radio more fun for everyone. We need to rebuild a spirit of cooperation and excitement. We need to counter the infighting and anger—the frustrations. We need to get away from repeater and net jamming—from those stupid ham lawsuits which are wasting money and time and generating fear. I'm not asking for anything we can't do or that we won't enjoy doing.

I need your help in getting more readers for *73* so we can make a difference. If every reader could get one more ham to subscribe to *73*, we'd have the strength we need to not only rebuild amateur radio, but also to make a significant difference in America.

"The Japanese electronics industry is at the heart of their rise to power . . ."

Yes, I agree, unless you know how to go about it, one person usually can't make any difference. But when you know where the lines of power run, you can tap in on them and even one person can make a profound difference. I discovered this for the first time back in 1970 when I found that I was able, with the power of *73 Magazine*, to make repeaters and FM happen. And I did make that happen.

It was my success with repeaters that gave me the courage to tackle the microcomputer when it first appeared in 1975. It was that confidence which drove me to start *Byte* magazine—then *Kilobaud*, *Microcomputing*, *80-Micro*, *Desktop Computing*, *RUN*, *InCider*, *Hot CoCo*, *Micro Industry*, and others—plus publish dozens of computer books, to build Instant Software with over 250 programs for fun, business, and education. I soon became the largest publisher in the field.

It was this same confidence that I could make a difference that got me to start *Digital Audio* magazine to support what was then a brand-new audio technology. With the help of my publications, compact discs have become the fastest growing consumer electronics industry in history.

One person really can make a difference. *You* can make a difference. You can do this by learning how to tap into the power system which runs America. Part of it is the media, part is Congress, and part is your local and state governments. These power systems are far easier to influence than most people suspect. Well, I know how to use these systems and I'm going to teach you how to do it. We're going to use this knowledge to get amateur radio going, and that's going to get America growing. Let me ask you, do you see any other route to getting America back to #1? Any?

To make this happen I need double the number of *73* subscribers. Even knowing how to use the power system, I still need your help. Once I show you how to use it you'll be astounded at how effective you, one person, can be in making things happen. We have the lever to move the whole world—starting with America. But I need 100,000 people leaning on that lever with me, so let's get started getting more *73* subscribers.

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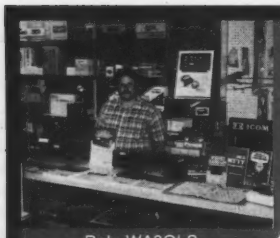

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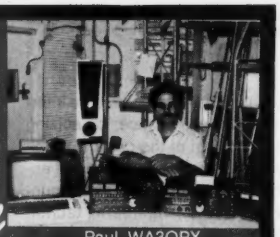

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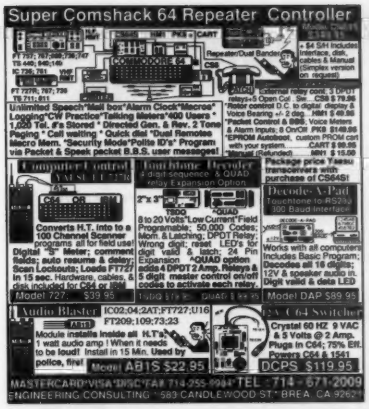
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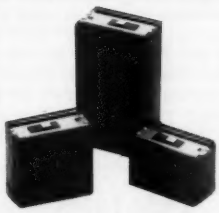

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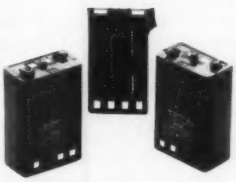

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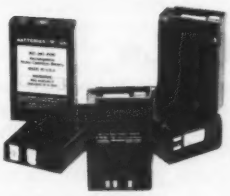

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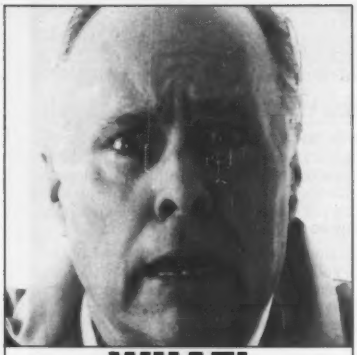

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6	Antenna Suggestions	Dec 77
7	Radio Shack Realistic TRC-II	Dec 77
8	The Publicom I	Feb 78
9	How about SSB Conversions?	Jul 78
10	Radio Shack TRC-11 and TRC-74	Aug 78
11	Radio Shack Realistic Mini 23	Sep 78
12	Hy-Range 681A (Hy-Gain)	Sep 78
13	Kraco KCB-2310B	Oct 78
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19	Midland 13-882C and Other PLL Rigs	May 79
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23	CB to 10 FM - Part I	Jan 80
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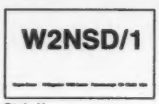

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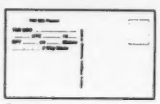
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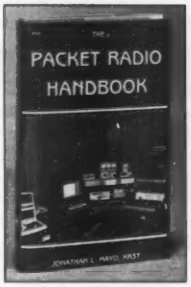

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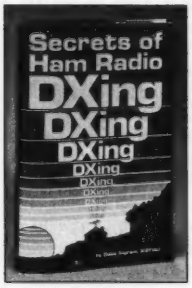

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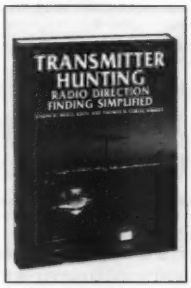

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We Get Letters...

Time to hit the mailbag, which I've neglected over the past few months. Some noteworthy correspondence has come in from a variety of sources, and all of it merits discussion. So without further ado...

Microwave Propagation

Glenn Elmore N6GN had some interesting comments regarding the "Trip Through the Microwave Spectrum" article in the October *73*. Glen feels that some of the points about propagation might deter more activity on the microwave bands and that clarification is in order.

Glen took exception with the statement that "Radio waves at this frequency propagate line-of-sight and are largely limited by atmospheric attenuation." Granted, this is a very broad statement, and path losses at these frequencies are higher than in the VHF and UHF bands. He described a table from the *ITT Reference Data for Radio Engineers* that plots attenuation in decibels per kilometer (dB/km) versus precipitation in millimeters/hour (mm/h) as a function of frequency.

Using this table, Glen claims that "atmospheric attenuation is really not a very significant issue, even in situations of heavy rainfall, until the 24 GHz amateur band." The table shows that with precipitation of 10 mm/h (about 0.39 inches/hour), the additional losses over a given line-of-sight (LOS) path at 2.3 GHz amount to an extra 0.0014 dB/km, which is fairly insignificant. The RSGB *VHF/UHF Manual* corroborates this table, attributing about a 1.5 dB increase in attenuation over a 10 GHz LOS path with 50mm/h rainfall, which is a fairly heavy shower, and certainly not the norm.

Glen goes on to calculate that a station running 1–2 Watts with a 20 dB antenna can achieve successful communications over a greater path than the 10–15 mile radius described in the article. He sets up the assumption that both stations at the ends of a hundred-mile LOS path are using 20 dB antennas. The total signal strength ratio = [+30 dBm (TX power)] + [+20 dBm (TX antenna)] + [−145 dBm (path loss)] + [+20 dB (RX antenna)] = −75 dBm signal. Assuming an SSB signal with a 3 kHz bandwidth, the noise floor ratio is [−139 dBm (KTB in 3 kHz)] + [+3 dB (RX noise figure)] + [+3 dB (terrestrial noise)] = −133 dBm. Subtracting −75 dBm from −133 dBm leaves 58 dB S/N. (His assumed feedline losses have been factored into the antenna gain and noise figure calculations.)

Reality Check

These figures, however, are for a true line-of-sight path, not one partially obscured by trees, buildings, etc. The reality is that many home microwave stations are not functioning over LOS paths during a large percentage of their contacts, and have to contend with numerous obstructions, as well as multipath and other distortion of the propagated wave. Indeed, here on the East Coast many of the paths regularly worked depend more on troposcatter or ducting effects, which occur so frequently (such as along the coast) that users may assume they have a largely LOS path.

For the average home station in the northeastern US, there are very few true LOS microwave paths. This typical station has so many factors working against it (feedline losses, foliage, antenna height, noise) that a day-to-day working range is realistically about one-half to one-third the ideal 2304 MHz LOS path (given the above calculations). During the spring sprints in May when there is little or no enhancement, stations running 25–50 Watts to 20 dB+ arrays have to scratch to make contacts over a hundred miles.

As to the effects of precipitation, I have observed significant attenuation when operating from what could be called optimum sites, e.g., mountaintop locations with something approaching true LOS paths to stations over a hundred and fifty miles away. For instance, during my last microwave grid expedition to Cathead Mountain in FN23, I observed erratic paths on 2304 and 1296 back to stations in eastern Pennsylvania and Rochester, New York. At the time, a heavy rainfall had just ended and dense clouds were drifting across the mountaintop during QSOs. Signals appeared to be stronger when the clouds cleared the mountain.

Again, because these were not true LOS paths, it's likely that what I was really seeing was some degree of erratic tropospheric enhancement, caused by cooler layers of air trapped by warm moist air, and a partial duct alternately forming and breaking up to the top of Cathead. This could be misinterpreted as the effect of precipitation scatter or absorption!

> ***"...many home microwave stations are not functioning over LOS (line-of-sight) paths for most of their contacts."***

Glen's comments are thoughtful and insightful. He concludes by saying, "All of those whom I know that have become active with good narrowband stations at 1200 MHz and above remark how much 'better' these bands are for DX than VHF...I think the prevalent perception of mystery, line-of-sight only and high attenuation...have caused us to miss out on better utilization of these bands." Well put! The true microwave experimenter should take these observations as an incentive to further explore the bands above 900 MHz. You could be pleasantly surprised!

Running 9913 Coaxial Cable

Bertram Green W2LPC writes in to inquire about an old friend...9913 coaxial cable. He plans to run a hundred feet of it through some PVC tubing under his lawn to his antennas. Problem is, the PVC has a tendency to collect water, and he's concerned about the old 9913 bugaboo—water absorption. (We all know that 9913 makes a great garden hose if not properly sealed.)

The first thing to remember about Belden 9913 is that it has a contaminating jacket. That means that water can seep through the jacket and infiltrate the cable, drastically changing its impedance and possibly causing flashover at a high RF voltage point. Therefore, I don't advise direct burial of 9913 is unless it is somehow waterproofed. Running the cable inside a piece of PVC might do the trick, except that condensation can form and collect inside the tubing. If enough gets in there, you might as well have buried your 9913 in the pool!

The logical answer is to simply not use 9913. Select, instead, an appropriate non-contaminating RG/8 cable, such as RG-213. It has higher losses than 9913, but it resists water. Certain types of hard-line are also suitable for direct burial, and this may in fact be the best choice, since the cable needs to be strong and won't be flexed. Prodelin Spir-O-Line and Andrew Heliax are excellent choices. The higher cost of the cable is offset by knowing you won't need to dig up the lawn in six months to replace it!

Bad News and Good News

Thor Stefansson TF6PS wrote from Iceland regarding the use of a Microwave Modules 144/28 transverter to be used with an ICOM IC-751. He reports that the transverter output from the IC-751 is low (no surprise) and he would like to know how to squeeze some extra drive from it. This low output condition also existed on the IC-730, 740, and 745 series radios, where anything from 1 mW to 3 mW was nominally available at 28 MHz. In some cases, the output was even lower and sometimes measured below 1 mW or 0 dBm.

The good news is that late model MMTs have excellent sensitivity in the low-level TX mixer stages. I performed measurements with 1987 model MMT 144/28 10 Watt units and was able to saturate the mixer with as little as 1 mW of drive, so you shouldn't have a problem unless your IC-751 has less output. ICOM typically samples the transverter line well before the last RF driver stage, and I modified my IC-740 to sample the 28 MHz energy just before the PA board. In this case it was an easy modification, as the coax was bro-

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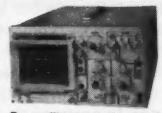

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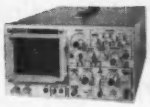

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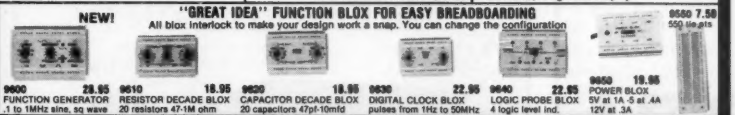

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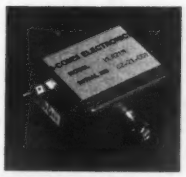

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ken and brought to the rear panel XTVR jack, and the PA return was through the SPARE jack.

This modification resulted in as much as +12 dBm drive—more than adequate for the job. The modification for the IC-745 was similar, and involved disconnecting the LOW BAND ANT jack to use as the return back to the PA board. Again, the modification resulted in about +10 dBm output as opposed to the +3 dBm output (2 mW) on the stock IC-745. Modifying the IC-745 is somewhat more difficult, as the coax lines to the PA and mixer must be traced back carefully. Otherwise, you may accidentally connect the output from the low-pass filter board and pump 100 Watts, or +50 dBm, into your transverter!

In any case, make sure that the 1.5k, ¼-Watt resistor in series with the input is shorted before you try anything else. Strapping this resistor in both the 28 and 28R models results in about a 7–10 dB increase in output. Increase the sensitivity of the mixer injection level pot slowly and see if the output isn't a lot higher. If that doesn't work, then you may wish to modify your ICOM to obtain the extra drive.

Goodbye, Yellow Brick Road...

Nearly four years ago, I approached the then-Managing Editor of *73 Magazine* with the idea of running a regular column of interest to VHF operators, pointing out the continued growth of activity in FM, packet, SSB, EME, and satellite modes. After much persuasion, "Above and Beyond" became reality in August of 1985, bringing me the challenge of writing stimulating articles on a variety of VHF topics.

"I don't advise direct burial of 9913 unless it is somehow waterproofed."

The years since have indeed seen a surge of interest above 50 MHz. The 23 centimeter band continues to expand. Fast Scan ATV has helped the growth on 23 and our newest allocation on 33 cm. Grid squares came into widespread acceptance to further stoke the fires, as did the ARRL Sprints and the CQ VHF WPX contest. Equipment for 220 MHz became more readily available, and Novices regained VHF voice privileges after 20-odd years.

There's been a down side, too. The explosion of repeaters and the FCC's decision to back away from regulating ham radio created serious problems. The apparent loss of 2 MHz from 220 comes at the worst possible time on a band that is growing in fits and starts. Both 23 cm and 13 cm felt the butcher's knife as over 50 MHz was removed from the amateur allocations. The 70 cm band remains a likely target.

All of these events have combined to focus attention on the VHF, UHF, and SHF spectrum as never before, as both commercial and amateur interests become aware of the potential for these frequencies. If this column has helped to focus that attention in some way, all the better. If someone was persuaded to try a grid hop...buy a new transverter...build a preamp...write a Congressman about the threat to 220 MHz...write to dispute the statements in this column...operate a VHF contest...fire up a packet station...try 6 meter FM...it was worth it.

Sometimes in life you find it necessary to step back and re-evaluate many of the activities you participate in. It's a good and necessary process, and more of us should take time to "stop and smell the roses" once in a while. I have decided to scale back my amateur operations for the time being, including writing. It has truly been an enjoyable 3½ years and I have made many friends over that period. It's been a pleasure writing "Above and Beyond," and perhaps one day I will pick up where I left off.

So...keep at it! The majority of bands above 50 MHz are still vastly underused. The key to keeping them in the amateur allocation table is activity...activity...ACTIVITY. And who knows? I might just pop up from a mountaintop in some rare grid to work you...Above and Beyond!

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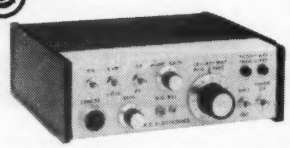

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Maryann (WB6YSS)

ATV *Continued from page 64*

section of transmission line between the transmitter and antenna. The main idea is to make certain that the sampling section does not disturb the impedance of the transmission line. The ideal situation is to keep the transmission line impedance electrically constant. To keep the impedance discontinuities minimal, the physical ratio of the outer and inner conductor sizes must provide the proper impedance and be equal to that of the transmission line sampled." W8DMR gives the formula for calculating the impedance based upon the conductor sizes using air dielectric:

The impedance in Ohms is:

$$Z_0 = 138 \times 10\log \frac{\text{outer inner diameter}}{\text{inner outer diameter}}$$

Ratios of 2.304 and 3.496 provide 50 and 75 ohms, respectively.

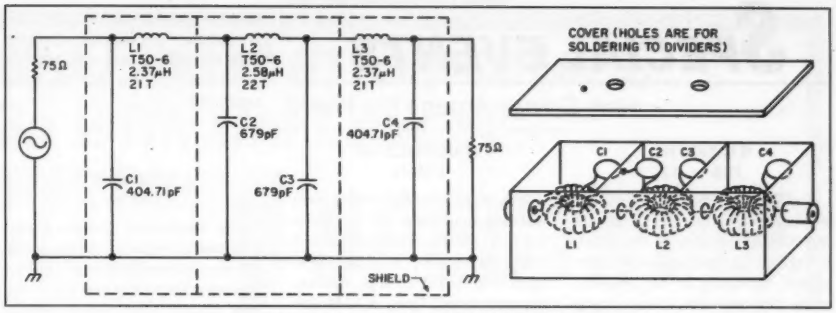

Figure 3. Layout of the 7-Pole Video Filter.

WB6BAP's 7-Pole Video Filter

Here are the construction details on a simple but effective 7-pole video filter designed several years ago by Ernie Williams WB6BAP of the now defunct Southern California ATV Club. This filter helps reduce output garbage at your modulator and may prevent stray RF from creeping into your monitor, VCR, or distribution amplifier (see Figure 2).

It's cheap, simple, and straightforward (see Figure 3). It uses no power supply or active components, and it doesn't heat up. As Ernie said in the later "A5" article, "It is user friendly!"

The inductors are Micrometals T50-6 toroid cores (or equivalent). You may parallel small values or check standard values caps on a bridge to find the closest value. Make plenty of good grounding areas. The enclosure can be anything metallic. Connectors are not important, although Ernie used BNCs. Ground the enclosure to something nearby when installed.

Good luck! Write and tell me how you came out. For more serious filter problem-solving, contact John Beanland G3BVU/W1 at Spectrum International in Concord, Massachusetts. He has some real neat 3- and 5-pole brass and copper specialty filters that are reasonably priced, and which will notch out just about anything! 73's gang and see you next month. . . de WB0QCD. 73

Parts List for Line Sampler

R1	33kΩ ½ W	input resistor	RS 271-040
R2	1kΩ ½ W	feedback resistor	RS 271-023
R3	10kΩ ¼ W	level adj. pot	RS 271-335
R4	47kΩ ½ W	bias resistor	RS 271-042
R5	22kΩ ½ W	bias resistor	RS 271-038
R6	15kΩ ½ W	base resistor	RS 272-036
R7	100Ω ½ W	collector resistor	RS 27R-012
R8	470Ω ½ W	emitter resistor	RS 276-019
C1	1 pF	ins. wire near coax center lead	fabricate
C2	4.7 pF, ceramic cap.	RF bypass	RS 272-120
C3	100 pF, ceramic cap.	RF bypass	RS 272-123
C4	10 μF, 16 V cap.	coupling	RS 272-1436
C5	220 μF, 16 V cap.	decoupling	RS 272-956
L1	1.0 μH, AWG #26	10 turns, ¼" dia.	
D1	1N34A diode, ger.	demodulator	RS 276-1123
Q1	2N2222 NPN, bipolar	emitter follower	RS 276-2009
Q2	2N2222 NPN, bipolar	line driver	RS 276-2009
HS	heat sink for Q2	cooling	fabricate
S1	connector, BNC	RF level, DC	RS 278-105
S2	connector, SO-239	video output	RS 278-201
PC	pre-drilled PC board	parts mounting	RS 276-150
SK	transistor sockets	optional, 2 required	RS 276-548

A Comparison of Popular 1-Watt Rigs
as tested by the BRATS ATV Club

MFG. Features	PC TC-70	Wyman WR-450
Suggested Retail Price	$299	$300
Transmitter RF Output	1 watt PEP	2.5 watts PEP
Crystal freq. capability	2	1
Vestigial SSB filtered	NO	NO
Cabinet construction	Plastic	Metal
Power supply requirements	Internal	Included
Camera input connector	10-pin	10-pin
Accepts B/W and Color NTSC	Yes	Yes
Synch stretcher circuitry	Yes	Yes
Synch level WS lockup threshold	Fair	Very Good
Optional video input(s)	Yes	Yes
AM signal stability	Good	Good
Harmonic/Spurious radiation	Fair	Good
PTL (push to look)	Yes	Yes
Transmit Signal Video Monitor	Yes	Yes
4.5 FM subcarrier sound	Yes	Yes
On-carrier audio capability	No	Yes
TV subcarrier squelch	Option	Yes
Internal OC Rcv provision	No	Yes
Front panel controls	Yes	Yes
Transmit/Receive LEDs	Yes	Yes
Receiver sensitivity	Good	Good
Unwanted signals rejected	Fair	Fair
Full-band tuning	Yes	Yes
Service/parts replacement	Yes	Yes

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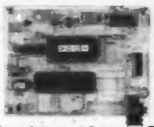

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RALEIGH NC
FEB 11–12

The Raleigh Amateur Radio Society club members will celebrate the 20th anniversary of the founding of their club with a special event station, operating on the weekend of the 11th and 12th, in the general portion of all bands. Members will use their own callsigns. QSL will be by sending a #10 SASE to *RARS, PO Box 17124, Raleigh NC 27619.*

LOVELAND CO
FEB 11–12, 14

KAO Valentines For Friends will be operating in conjunction with the Loveland Valentines Activities from 1500 to 0500 UTC on the above weekend, with some activity on February 14 from 2300 to 0500 UTC.

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MANSFIELD OH
FEB 12

The Mansfield Mid*Winter Hamfest/Computer Show will be held at the Richland County Fairgrounds in Mansfield. Plenty of prizes, 300-table flea market in large, modern, heated building. Open at 7 AM, tickets $3 in advance and $4 at the door. Tables $6 in advance and $8 at the door. Half tables available. Talk-in, call W8WE on 146.34/.94. Advanced ticket/table orders must be received by Feb. 2. Contact *Dean Wrasse KB8MG, 1094 Beal Road, Mansfield OH 44905. 419-589-2415 after 4 PM EST.*

MARLBORO MA
FEB 18

The Algonquin ARC is sponsoring the Hamfest/Flea Market in Marlboro from 10 AM to 2 PM on the above date. Open for sellers at 8 AM. Place: Marlboro Middle School Cafeteria, Union St., off Rte. 85. Feature: Electronics Flea Market. Talk-in: 146.01/.61 and 146.52. Admission is $2. Tables are $8/each in advance, $10 at door. Wheelchair accessible. Contact *Dan KB1WW at 617-481-1587 or write A.A.R.C., Box 258, Marlboro MA 01752.*

SALEM OR
FEB 18

The Salem and Oregon Coast Emergency Repeater Associations will sponsor the 1989 HAM FAIR on Saturday, beginning at 9 AM at the Polk County Fairgrounds. Admission is $5 in advance or $6 at the door. Activities include giant flea market, exhibits, and commercial dealers. Talk-in on 146.26/.86. For more information, write *Salem Repeater Assoc., PO Box 784, Salem OR 97308.*

DENVER CO
FEB 19

The Aurora Repeater Association will hold its 8th Annual Swapfest on Sunday from 8 AM to 3 PM at the Jefferson County Fairgrounds at 15200 W. 6th Ave., Golden CO. For additional information, contact *Judi WDØHNP at 303-460-1413 or Jan KA7TYU, PO Box 39666, Denver CO 80239.*

FELICITY CA
FEB 25

From 1500 to 0100 UTC, Amateur Radio Emergency Service Hams of Yuma, Arizona, will call all nations from The Official Center of the World in Felicity, using callsign WA6PEZ. 10 meter Novice SSB: 28.418 MHz; 15 meter General SSB: 21.318 MHz; 40 meter General SSB: 7.238 MHz. Call-in on 146.74 Black Mtn. Rptr. For glossy certificate, send QSL, 9x12 SASE and $1 to YUMA ARES %US Post Office, Felicity CA 92283. Any profits have been pledged to United Way of Yuma and El Centro. Contact *KCØKV Barry Norrgran, ARRL District Emergency Co-ordinator, 2404 Marion Ave., Yuma AZ 85365. 602-344-2575, evenings.*

CINCINNATI OH
FEB 25–26

The Ohio ARRL Convention 1989 will be at the Cincinnati Gardens Exhibition Center at 2250 Seymour Avenue. Fee is $5 per person, $6 at door. Door prizes, free parking, early morning coffee and doughnuts. Motel rooms available 1.5 miles from convention.

For details on flea market, contact *Lynn Ernst WD8JAW, 4553 Patron Ct., Cincinnati OH 45238. 513-921-4882.* For information for commercial vendors, contact *Joe Weinle WD8JGB, 6060 Dryden, Cincinnati OH 45213. 513-731-3208.*

LA PORTE IN
FEB 26

The LaPorte ARC is sponsoring its Hamfest at the LaPorte Civic Auditorium. Admission is $3.50. Tables are $3/each, reserved in advance. Talk-in is on 146.520 or 146.610 with PL of 131.8. Contact, with SASE *LPARC, PO Box 30, LaPorte IN 46350.*

DEARBORN MI
FEB 26

The Livonia Amateur Radio Club will hold its 19th annual LARC Swap 'n Shop on Sunday from 8 AM to 4 PM at the Dearborn Civic Center in Dearborn. ARRL/VEC amateur radio examinations will be given by the Motor City Radio Club. Plenty of tables, door prizes, refreshments, and free parking. Talk-in on 144.75/5.35/.52. Reserved table space of 8-foot minimum available. For further information, send 4x9 SASE to *Neil Coffin WA8GWL, %the Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.*

CUYAHOGA FALLS OH
FEB 26

The Cuyahoga Falls ARC 35th annual hamfest will be at the Akron North High School from 8 AM to 3 PM. Tickets are $3 in advance, $4 at the door. Tables are $5, with half-tables available. Sellers may bring own tables. Tables are $6 at the door, if any are left. SASE for ticket orders and table reservations, please. Talk-in on 87/27. Details from *Bill Sovinsky K8JSL, 2305 24th St., Cuyahoga Falls OH 44223. 216-923-3830.*

DAVENPORT IA
FEB 26

The 18th annual Davenport Radio Amateur Club Hamfest is scheduled for Sunday at the Iowa Masonic Temple in Davenport, Iowa. Talk-in on 146.28/.88. Doors to the WØBXR hamfest will open at 8 AM. The event features a large indoor flea market, food, forums, prizes, and ARRL/VEC exams (walk-ins accepted). Tickets are $2 in advance, $3 at the door. Tables are $7 each with an additional $2 charge if an AC hookup is required. For hamfest information, write to *Dave Johannesen WBØFBP, 2131 Murtle St., Davenport IA 52804.* For testing information or preregistration, write to *Al Broendel N9OK, 2712 38th St., Rock Island IL 61201.*

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March 4 - Philadelphia, Pa.
Philadelphia State Park

March 5 - Elizabeth, N.J.
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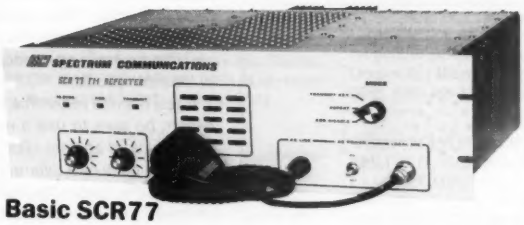

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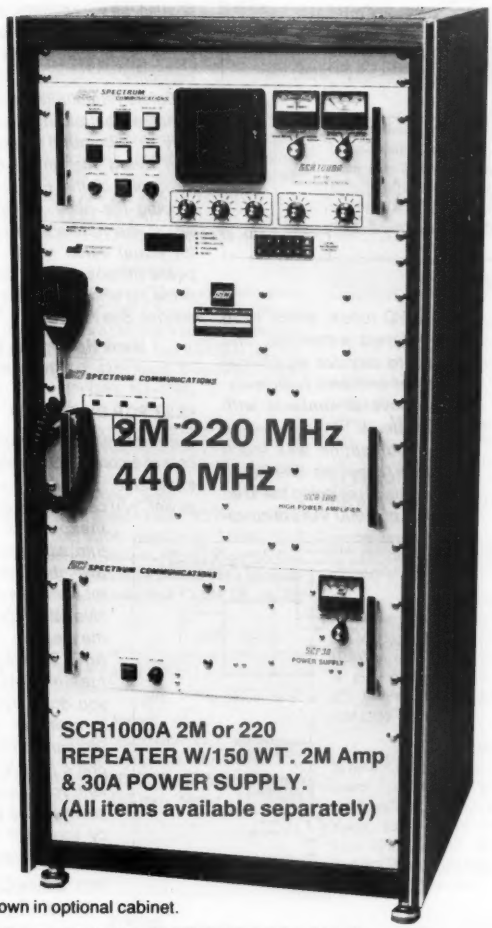

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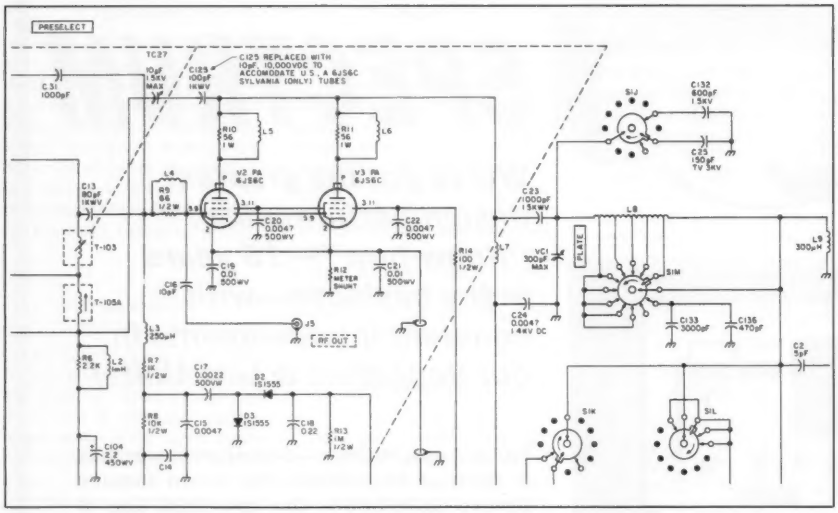


Figure 1.

FINALS REPLACEMENT

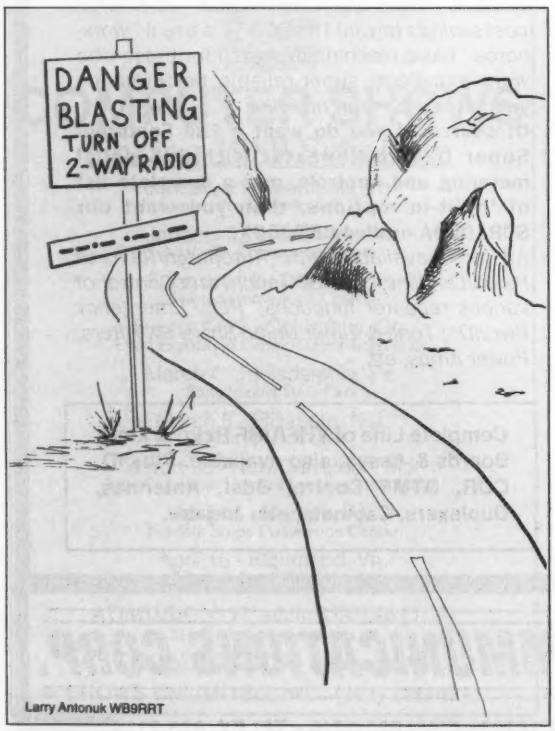
There came a time when I needed to replace a pair of 6JS6C vacuum tubes in the final amplifier section of a FT-101E. A salesperson informed me, however, that I needed to make a major modification in order for American tubes to perform properly and last a long time. The radio was originally equipped with Japanese NEC tubes, which have quite different properties. Not anxious to pay for additional services of unknown complexity, I made several contacts with fellow amateurs.

The modification was much easier than I expected. See Figure 1. It consists of replacing the fixed value 100 pF 1000 VDC mica capacitor with a 10 pF 1000 VDC mica capacitor. This capacitor, C125, is in series with the 10 pF variable neutralizing capacitor off of the plate circuit.

If you need to make this modification, be sure to use a mica or silver mica of at least 1000 VDC. Do not substitute a different type, because the heat in the final compartment will change the value, and your tubes will fail prematurely. Also, be very careful to keep all leads short and in exactly the same orientation as the original capacitor.

Before reneutralizing, open the variable neutralizing cap all the way to minimum engagement, and follow the neutralizing instructions in the manual. While dipping the plate, remember to adjust the neutralizing capacitor for equal value meter reading peaks (IC position) on both sides of the dip when tuning the "Plate" control. See Figure 1.

Hank Hausmann WB8RNI
Strongsville OH



Larry Antonuk WB9RRT

TEST FOR DIRTY BIRD

For many beginning hams, the cost of a commercial wattmeter is excessive. If you're using low power, you can make a quick and inexpensive substitute with almost any available milliammeter and a few inexpensive parts, as seen in the diagram. If you're only interested in maximizing output you don't even need to calibrate it, but if you can borrow someone's Bird or equivalent, you can calibrate yours for the frequency you wish to measure. See Figure 2.

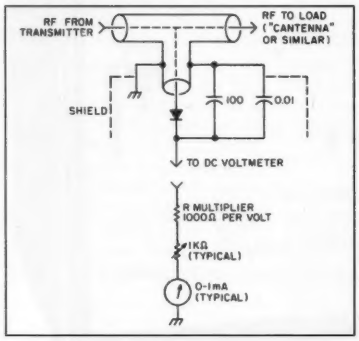


Figure 2.

Wm. Bruce Cameron
Temple Terrace FL

PORTABLE PACKET

Use your TNC with an ICOM HT! See Figure 3. Radio Shack part numbers are: for C1, RS 272-1432; for R1, RS 271-1341.

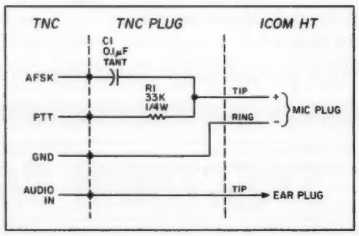


Figure 3.

Dick Peters
WA1PWF
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ASK KABOOM

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Michael Jay Geier KB1UM
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The Way It Goes

About ten years ago, when I was a professional service technician, my boss spoke the words I will never forget: "If it works, it breaks!" Ain't it the truth! Nothing keeps working forever. In troubleshooting, however, I found that parts didn't "go" randomly—some types of parts, in some types of circuits, seemed to nearly always be the culprits, while others could be counted on to be OK. And I've come to believe that understanding this phenomenon is a great part of what separates the expert techs from the diddlers. (An in-depth understanding of the circuit doesn't hurt, either!)

So, this month I'm going to break down common parts by type, in decreasing order of likelihood of failure:

Connections: A connection aisn't always a component, but it can be, in the case of switches and relays. Bad connections are by far the most common cause of equipment failure. Solder joints are included here.

Stressed transistors: These include voltage regulators in power supplies (especially), RF and audio output transistors, and in general any transistors that get warm enough to require heat sinks.

Zener diodes: By virtue of their very function (voltage regulation), they handle significant current and sometimes get hot. Over time, they can go, becoming open circuits. This may result in a power supply going way over its intended voltage, causing all kinds of damage, especially to 5 volt digital ICs in other parts of the rig.

Linear ICs (such as op amps and audio amps): These are frequently required to handle wide voltage swings and surprising currents. They can get hot and die just like stressed transistors.

Small-signal transistors: They will go if over-stressed with too much current, but they can also die for no apparent reason. If you're doing a stage-by-stage signal trace in an IF strip not made from ICs, for example, the transistor in the dead stage will nearly always be the culprit. Be especially wary of FETs and MOSFETs in receiver front ends, as they are easily killed by atmospheric static pulses or nearby transmitters.

Rectifiers: These are pretty reliable, but they can be overstressed like any other semiconductor. They are easy to check with an ohmmeter.

Crystals: They're easy to overlook, but I have seen plenty of flaky and just plain dead ones. They are especially suspect in oscillators that work sometimes but not always.

Digital ICs (such as gates and microprocessors): TTL (74-series) chips die quickly if the supply voltage goes much above 5 volts. CMOS chips are more tolerant and reliable. When digital chips go, the result is nearly always an output line stuck either high or low.

Electrolytic capacitors: These are weird parts. They get leaky, open, and sometimes just plain strange, even occasionally exhibiting diode-like behavior. When in doubt, swap in a new part, even if it is not exactly the same value, just to find out.

Small-signal diodes: These are more likely to be open than shorted. They are easy to test with an ohmmeter.

Resistors: In tube circuits, heat may make resistors drift, but that doesn't happen in low-level solid state devices, and very rarely even in output stages. If a resistor is bad, it will be obviously burned or cracked, and the semiconductor device associated with it will invariably be shorted. If the resistor looks OK, it almost certainly is.

Ceramic capacitors: I've only seen one or two bad ones in my life. It just doesn't happen.

Inductors: Excluding high-voltage transformers associated with CRTs, they rarely go. If an inductor is open, look for a short circuit pulling too much current through it. If it is shorted, age or humidity is the likely cause.

Alignment: No! Sudden changes in performance are caused by bad parts. Don't diddle with adjustments unless and until you are CERTAIN nothing else is wrong!

In general, when checking any stage, first check the output of the transistor or IC, then check its input. If they are both doing something and not the SAME thing, then look elsewhere. (Of course, for digital gates and such, it is a bit more complex than that, but a digital gate with power applied, changing inputs, and no output is probably bad.)

Whew! Now let's look at this month's letters:

Dear Kaboom,

My Yaesu FT-901 works fine most of the time, but it sometimes arcs inside the output tubes upon keydown, especially on 160 meters. Surely that can't be good for the tubes. What gives?

Signed,
Zapped Again

Dear Zapped,

You're right, it isn't helping those tubes one bit. The cause is a dirty bandswitch. Take off the bottom of the rig and spray the switch's leaves with cleaner, then rapidly rotate the switch back and forth several times through all positions. While you're at it, spray and clean the variable capacitor behind the "plate" control the same way. By the way, Heath SB-220 amps are prone to the same problem.

Dear Kaboom,

My RTTY interface connects to the speaker output of my rig. It works, but I have to turn it up fairly loud sometimes for good print, and it drives me nuts! Is there any way I can increase the sensitivity?

Signed,
Headache #122

Dear Headache,

Yup, it's easy. Go to Radio Shack and get a miniature audio output transformer (catalog #273-1380) and a couple of 5 volt zener diodes. Connect the 8 ohm side of the transformer to the speaker output of the rig, and connect the diodes back to back (in other words, in parallel but opposite polarity) across the 1000 ohm side. Then connect the 1000 ohm side to the RTTY interface. The sensitivity should go up tremendously, and it's cheaper and safer than lots of pain relievers! 73

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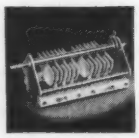

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Packet DX Spotting Networks

What does VHF FM packet radio have to do with DX? Everything, thanks to the innovative DX spotting software from Pavillion Software (PO Box 803, Hudson, MA 01749).

Dick Newell AK1A, who developed the software, has produced two different versions: one for small, local networks, and another for large networks capable of handling hundreds of DXers simultaneously, over thousands of square miles. These PacketCluster packages add a new dimension to tracking DX.

Packet Conference Bulletin Board

The stand-alone version, Packet Conference Bulletin Board (PCBS), runs on an IBM PC/XT or compatible computer, with a hard disk drive. This node, or central station, also needs a Kantronics KPC-2 terminal node controller (TNC) and a VHF FM transceiver, plus antenna, coax, etc., and a copy of the software. Most PCBS systems operate on 2 meters. The hardware commitment for the node is substantial—at least $1000 when starting from scratch. A local DX club may be able to find used radio gear, however, and also borrow a computer that would otherwise be idle, such as during non-business hours.

Fortunately, the individual DXer needs only a minimal packet system consisting of a suitable VHF FM radio, any model TNC, and a terminal, to get the system up and running. Older, crystal-controlled FM rigs, and inexpensive, surplus computer terminals are easy to find at hamfests, and the cost of a new TNC has dropped to only about a hundred dollars.

What does PCBS do for the DXer? A lot! The main function of the software is to store, organize, and disseminate detailed reports of DX stations, including callsign, exact frequency, time and date, the call of the station making the announcement, and a short note. The note might be QSL information, operator name, listening frequency, etc.

Any user of the system can enter a DX spot by simply typing in the DX station's callsign and frequency (and note, if any) into his or her terminal: DX/VP2ML 28495 QSL K1RH. The central computer logs and acknowledges the spot, adds the current time, date, and call of the spotting station, and immediately forwards the information to every other station connected to the system. If their equipment permits, users can set a bell to ring when the spot comes in. On a busy evening, the bell will ring continuously.

Even better, the central station node stores each DX spot indefinitely. This means a station doesn't need to be connected to the system at all times. A DXer can log into the system and ask for the last 5 DX announcements (or any number of DX spots, for that matter). The individual DXer can also specify a particular band, and get only those reports from that band. Want to know what's been on 160 meters the past week? Type SHOW/DX/24 160 for the last 24 DX spots on Top Band! DXers can even specify a particular country in their request: SHOW/DX VP2M will give the last five DX reports from Montserrat, including callsign, frequency, date and time, and logging station.

In addition to this DX spotting function, PCBS will provide beam headings for any country, give today's sunrise and sunset times for any country, and even predict the Maximum Usable Frequency (MUF) for a given path! Users can also enter and access WWV propagation data. Finally, PCBS contains regular packet bulletin board features, including the ability to talk to any connected station directly, and to store and retrieve mail, messages and DX bulletins, such as the contents of W1AW's DX bulletin.

This sophisticated software asks for the operator's name and location, then the data is accessible by any local user. Hear a callsign and want to know the operator's name and town? Type SHOW/USER (Callsign) and PCBS will tell you. Another innovative feature is the EXCLUDE function, which is very useful for contesters in the single-operator category. Because of some controversy over single-operator status for stations using DX spotting nets (they are *not* single operator, and are automatically reclassified as multi-operator entries), PCBS's EXCLUDE function can prevent the flow of DX information *to* a given station. That station can continue to feed DX spots *into* the system, to help those operators entering the contest in a multi-operator category, but the single operator does not receive any information back. And this EXCLUDE function is controlled by the system operator, not the individual contester, eliminating violations of the honor system.

The node operator ("sysop" in packet lingo) can add specialized data bases to the software, such as names and contest scores of local club members, oblast' lists, DX news filed by prefix, and whatever else would be useful for club members.

PacketCluster

PCBS is limited to a maximum of 26 users at a given time, a limit imposed by the TNC. Also, distant stations may have to use more than one digipeater to access the

Continued on page 93

```
SH/DX/20 10
28510      YC0MCA      10-Oct-1988  0309Z  good sig.                    <K2ITG>
28525      HL2IDJ      10-Oct-1988  0238Z                               <N6SKF>
28494.8    BY8AC       10-Oct-1988  0226Z   Calling CQ USA              <KD6PY>
28509.6    YC0MCA      10-Oct-1988  0224Z                               <N6SKF>
28450.3    HL9OB       10-Oct-1988  0224Z                               <K6PBT>
28450      HL9OB       10-Oct-1988  0220Z                               <N6SKF>
28449.9    3D2YL       10-Oct-1988  0216Z    Karen                      <K2ITG>
286039     KX6BU       10-Oct-1988  0035Z                               <WJ6O>
28026.1    PU1LIU      10-Oct-1988  0005Z                               <NC7K>
28033      BY4RB        9-Oct-1988  2353Z                               <N6JV>
28492.8    KD7P/KH2     9-Oct-1988  2327Z                               <WJ6O>
28502.2    4U43UN       9-Oct-1988  2237Z  New York                     <KJ6LD>
28024      OA4ZV        9-Oct-1988  2146Z                               <N6JV>
28007.6    CU2BU        9-Oct-1988  2114Z                               <N6JV>
28456      AX4ABX       9-Oct-1988  2112Z                               <N6SKF>
28522.4    ZY0TT        9-Oct-1988  2056Z  QSX 28553                 <K6AYA-15>
28522.3    ZY0TT        9-Oct-1988  2051Z  listening 28550 up           <K6PBT>
28487.8    WY5L/KH3     9-Oct-1988  2035Z                               <KD6PY>
26509.0    5H3RB        9-Oct-1988  1855Z  ROEL                      <WA6HAN>
28039      GU0FYR       9-Oct-1988  1841Z                               <N6JV>
```

Figure 1. The results of typing "SH/DX/20 10."

```
PacketCluster Configuration:

PacketCluster node: (WG6H-1)

PacketCluster node: (K6LLK)
(WA6ALZ)     K6SIK        WB6JXU       W6XB         (K6TMB)

PacketCluster node: (KN6J)
W0YK         (WA9WYB)     N6JL         (KJ6FD)

PacketCluster node: (W6LEH)

PacketCluster node: W6GO
(K6PBT)      (WG6P)       WA7G-6       (WA6OEC)     WA6JCD-15    K6YK

PacketCluster node: (W6OAT)
WD6CJB
```

Figure 2. The PacketCluster Configuration display, showing both the nodes and the stations connected to same.

```
SH/WWV/10
   Date        Hour  SFI   A   K        Forecast
11-Oct-1988    04    179   46   5   low-moderate/active                <WN6W>
10-Oct-1988    00    176   16   1   Low/Unsettled                      <KD6PY>
 9-Oct-1988    17    174    7   4   Low/Unsettled                      <KD6PY>
 9-Oct-1988    15    174    7   4   low/unsettled                      <WN6W>
 9-Oct-1988    01    174    7   1   Low/Unsettled                      <KD6PY>
 8-Oct-1988    18    174    7   3   Low/Unsettled                      <K6PBT>
 8-Oct-1988    03    181    7   1   Low, Quiet                         <W6OAT>
 8-Oct-1988    01    181    7   1   Low, Quiet                         <W6OAT>
 7-Oct-1988    19    181    7   2   Low-Mod/Quiet-Unset               <WA9WYB>
 7-Oct-1988    18    181    7   2   Low-Mod/Q-Unsettled                <K6PBT>
SH/DX
21291.8    UB4MRG       11-Oct-1988  1512Z  CLG CQ                    <WA9WYB>
21246      ON4VN        11-Oct-1988  1510Z                            <WA9WYB>
21235      UA6LBH       11-Oct-1988  1509Z                            <WA9WYB>
14182      VU2DNL       11-Oct-1988  1451Z                            <WA9WYB>
14164.5    HK0EOU       11-Oct-1988  0633Z  SANANDRES                 <WA9WYB>
```

Figure 3. The results of the command "SH/WWV/10," and of SH/DX (the last five spots, regardless of band).

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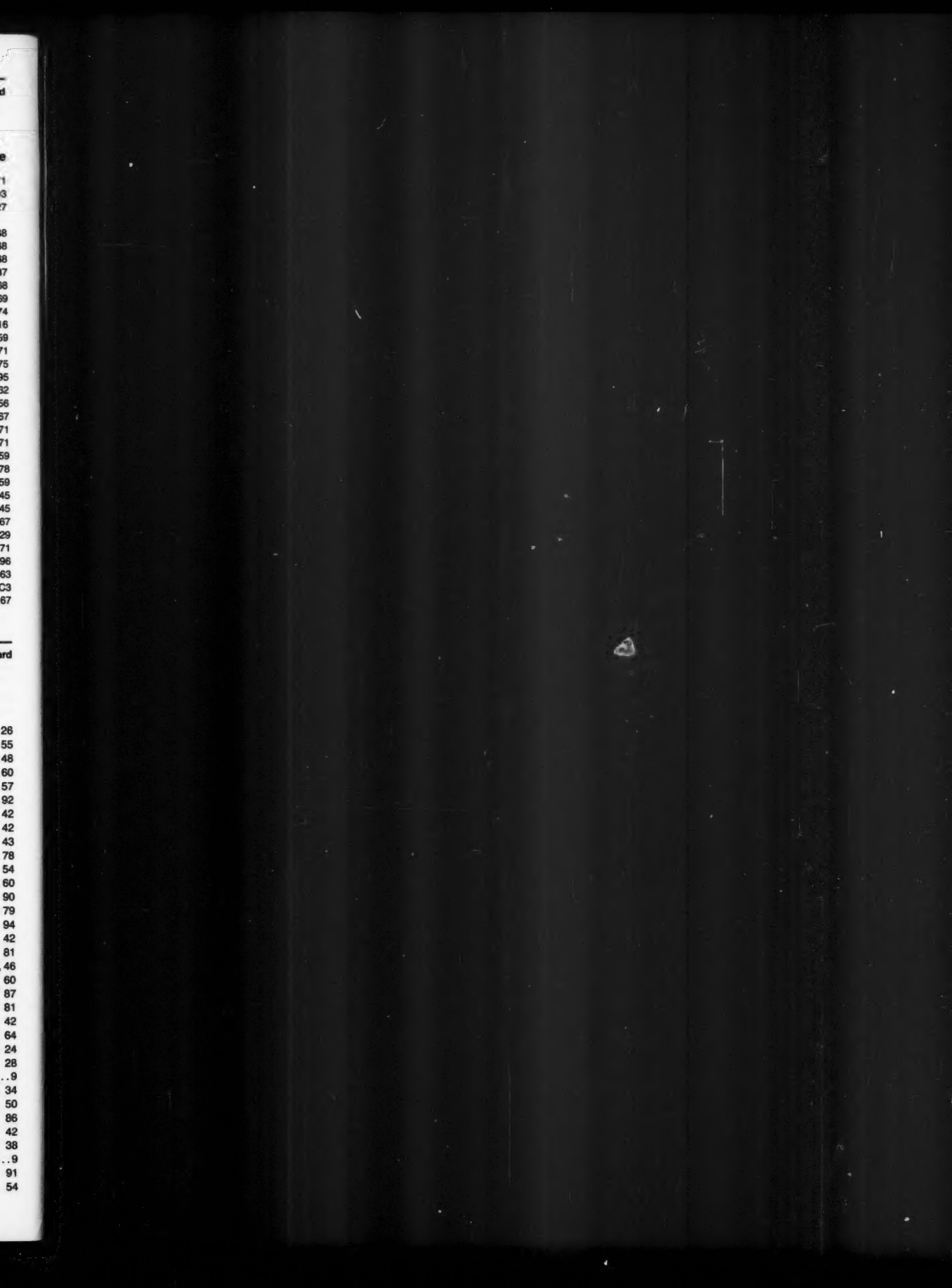


AERIAL VIEW

Antenna News

Arliss Thompson W7XU
RR 3 Box 224
Sioux Falls, SD 57106

Simple Antennas for 17m

In 1979 the World Administrative Radio Conference (WARC) promised amateurs access to three new HF frequency bands. They were in the neighborhood of 10.1, 18.1, and 24.9 MHz, commonly known as the 30, 17, and 12 meter bands. US hams gained access to the 30 meter band in October 1982, and in 1985 were allowed to move onto the 24 MHz band.

The FCC has withheld the 18 MHz band from us for nearly ten years, but we may very well be allowed to operate on that band by the middle of 1989. Conditions on the HF bands have improved considerably from what they were a couple of years ago. The 18 MHz band should provide many interesting openings, plus the thrill of operating on a new band. But, while many of us own transceivers that will be ready to go when the FCC finally opens 17 meters, few of us have antennas for that band. Now is the time to start considering what sort of antenna you will be using when the first US amateur signals appear in the 18.1 MHz band.

Make Do?

Perhaps the easiest solution is to use an existing antenna designed for another band. Whether or not this gives good results varies with each individual installation, but in general a coax-fed dipole cut for another band will not be a good performer on 17 meters. Even if you use an antenna tuner to provide a reasonable match between the transceiver and the feedline, the resultant high SWR on the coax will be associated with high feedline losses. If you're using a coax feedline, a high SWR will also dictate low power. In short, while you might be able to squeak a few contacts out of such a setup, it would be far from ideal.

All-Band Antennas

If you enjoy operating on all the HF bands, but have room for only one antenna, you may already be using a multiband wire antenna. The most common examples of this type of antenna are end-fed wires (Figure 1) and open-wire, center-fed dipoles (Figure 2). Both of these, when used with an antenna tuner, gives good multiband performance. Unlike the coax-fed dipole operating far from resonance, a dipole fed with open-wire line can be quite efficient. The losses associated with a high SWR and open-wire line are typically much less than they are with coax operating under the same conditions. This means that the open-wire, center-fed dipole you may have been using on the 80 and 40 meter bands will also work well on 17 meters by merely retuning your transmatch. If the antenna is over 26 feet long, it will even show some gain at 18 MHz. If you want to operate on all or many HF bands, but you have limited space for antennas, the center-fed dipole deserves serious consideration.

End-fed antennas, including directly-fed antennas may give a good account of themselves in multiband use, although my experience with them is that they commonly produce only mediocre results. Moving to 18.1 MHz with such an antenna requires only the retuning of the matching network. If RF feedback should arise (a common malady associated with end-fed antennas), you can cure it by improving the grounding. Attach a ¼-wavelength long wire (about 13 feet for the 17 meter band) to the transmitter to serve as an artificial ground. This causes a low impedance condition at the transmitter, so any RF feedback problems should disappear. Do not attach this artificial ground wire to actual ground; just run it around the shack or hang it out the window above the earth. Attaching it to another grounded wire will upset its quarter-wave resonance and nullify its beneficial effect.

Another problem that arises with end-fed antennas, which are relatively long for the band you select, is directivity off the end of the antenna. That may be fine if the antenna is horizontal, but if a substantial portion of the antenna is vertical, much of the radiated signal may be wasted. This will be particularly true when you're operating at a frequency as high as 18 MHz, where most signals arrive at a fairly low angle of radiation. By the same logic, "force feeding" your low-band vertical to allow operation on the higher HF bands will probably not yield good results.

The Dipole

While many of us enjoy the benefits of yagis or other gain-producing antennas when operating on the 20, 15 and 10 meter bands, a simple dipole (Figure 3) can be a good alternative when moving to a new band. When US hams finally get onto 17 meters, most will be using compromise antennas and few will have beams. If you have only a dipole, you won't be at a serious disadvantage compared to the rest of the stations operating on that band. In fact, more than a few DXCCs have been earned even on 20 meters by stations using no more than a dipole. For best results, the antenna should be mounted at least ½-wavelength (roughly 30 feet for 18 MHz) above ground to achieve a reasonably low angle of radiation. You may feed the dipole directly with 50Ω coax, or you can install a 1:1 balun at the feedpoint, if you desire. An alternative to the balun is to coil a few feet of the feedline into a circle 4–6 inches in diameter at the antenna. Five turns should do. This serves as an RF choke and thereby reduces the odds of unwanted RF currents flowing on the outside of the coax.

The Ground Plane

Another old standby on the higher HF bands is the ground plane antenna (Figure 4). This antenna provides omnidirectional coverage and, when mounted well above ground, a low angle of radiation. For 18.1 MHz the vertical portion of the antenna should be 12' 11" long. You can make the radials (usually four) 5% longer. If you bring the radials off at a down-sloping angle, say 45 degrees, the feedpoint impedance of the antenna rises to approximately 50Ω. Even if you run the radials horizontally, however, you may feed the antenna directly with 50Ω coax and still not cause a serious mismatch. You could also feed the antenna through a ¼-wavelength transformer of 75Ω coax to improve the match to 50Ω coax.

Summing Up

These are some ideas for getting an antenna onto 17 meters. You may want to get an antenna up now and listen on 17 meters to see who is operating there. Remember, of course, not to transmit on that band until specifically authorized to do so, even if you hear foreign amateurs operating there (some foreign governments already allow their hams to use the band).

See you on 17!

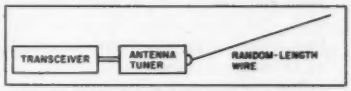


Figure 1. End-fed random length wire.

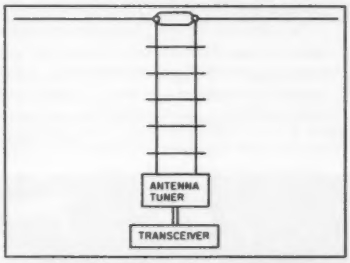


Figure 2. Open-wire, center-fed dipole. Minimum dipole length will vary with the lowest frequency. For operating at 3.5 MHz and higher frequencies, the dipole should be at least 66 feet long.

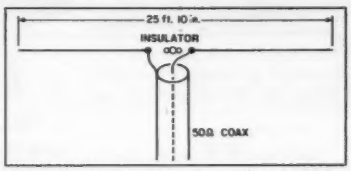


Figure 3. Coax-fed dipole for 18.1 MHz operation.

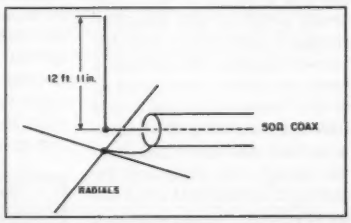


Figure 4. Ground plane antenna. The 4 radials are each 13' 11" long. For improved match to 50Ω coax, the radials may be angled downward. Insulate the ends from ground.

Number 30 on your Feedback card

NEW PRODUCTS

Compiled by Linda Reneau

PRODUCT OF THE MONTH

PacComm TRANSCEIVER REMOTE CONTROLLER

The Model RCH-1000, PacComm's Transceiver Remote Controller, has a remote control head (2.25"x7.38"x1"), speaker enclosure, transceiver interface box, and interconnecting cables. The remote head has tuning and volume control, LCD frequency display, 100 memories, 15 other parameters, and a 12-key function keypad.

The unit's software supports all popular transceivers. The Model RCH-1000 provides mode change, memory selection and update, and A and B VFOs, including splits.

Accessories include: fixed-site installation kit; mobile installation kit; marine installation kit; and non-standard interconnection cable lengths. Suggested retail price, $395. For more information about the features and specifications of the Model RCH-1000, contact *PacComm in Tampa, Florida, at 813-874-2980.*

CIRCLE 201 ON READER SERVICE CARD

CIRCLE 202 ON READER SERVICE CARD

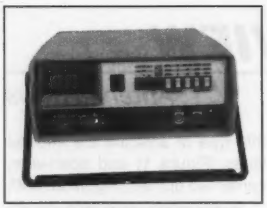
EEB

EEB's portable Computer/Radio Interface System, CRIS 6000, operates a variety of radios and greatly simplifies radio operation. Hardware consists of an interface box with cabling to the computer's serial port and the radio. Read up to 800 memory channels, edit RAM channels with built-in editor, write RAM channels to disk or radio memory, set mode and frequency to current RAM with a single keystroke. You can scan, and use four step sizes. You can log data quickly. The CRIS 6000 requires a few mA at 12 V DC.

CRIS software will be updated to support new radios and features. Its multi-tasking software is written in 'C' and assembly language. To use CRIS 6000, you need an IBM or compatible, with a serial port and at least 256K memory; a CRT, DOS 2.11 or later, and optional printer. Price, $349.95. Contact *EEB, 516 Mill St. NE, Vienna VA 22180. 703-938-3350. FAX: 703-938-6911. Orders: 800-368-3270.*

Aries-1™ Correction

Please note that the price of the Product of the Month in the January issue of 73, Aries-1,™ *a terminal and contest program, was incorrect. The correct price is $89.95. My apologies to Ashton ITC.—L.R.*



CIRCLE 203 ON READER SERVICE CARD

ELENCO ELECTRONICS, INC.

New from Elenco is a versatile 4½ digit portable instrument suitable for general electronics maintenance, production, and research. The Digital Bench Multimeter Model M-4500 has a built-in battery pack which provides 6,000 hours of continuous operation. It features 0.05% DC volt accuracy, integrated circuit electronics, solid-state LCD display, and push-button switch selection. All VOM functions, plus the versatile diode test and high–low ohm test functions, are included as standard. Each range has full auto-polarity operation and overrange indication. It uses the dual-slope integration measurement technique to insure noise-free measurements. The Digital Multimeter comes with operator's manual, test leads, and battery pack for $250. *Elenco Electronics, Inc., 150 West Carpenter Avenue, Wheeling IL 60090. 312-541-3800. FAX: 312-520-0085.*

AZIMUTH

Azimuth's WeatherStar Model TWR-3 by Digitar lets you monitor important local weather conditions affecting your antenna system and shack. The TWR-3's stand-alone computer with ⅜" LCD readout gives you wind direction (2- or 10-degree increments) and wind speed. It records high wind gusts, external temperature, wind chill, low and high temperatures, daily and yearly rainfall with optional self-dumping rain collector ($49.95). Scan Mode lets you see the data in any sequence. Lab accuracy is plus or minus 1%. Operates on three AAA batteries; AC adapter optional. NiCad Battery Pack and desk stand available.

The portable WeatherStar Model TWR-3 comes with wind vane, high-impact anemometer, UV resistant plastic, computer unit, and a 40-foot control cable. Price, $159.95, plus $4.95 S/H. For foreign orders, add $17 for shipping. Special free bonus: Azimuth Dual-Zone 24-hour Station/Travel Clock ($29.95 value). Contact *Azimuth WeatherStar, Dept. 73, 11845 W. Olympic Blvd., Suite 1100, Los Angeles CA 90064. Information, 213-473-1332. Credit card orders, call 800-882-7388.*

CIRCLE 204 ON READER SERVICE CARD

CIRCLE 205 ON READER SERVICE CARD

Media Mentor, Inc.

Carole Perry WB2MGP, creator of Media Mentor, Inc., has taught ham radio to hundreds of young people in the past eight years. She has used amateur radio to inspire and challenge her sixth, seventh, and eighth grade students to enrich their knowledge of electronics, science, math, communications, geography, and other cultures.

Carole WB2MGP has now packaged her expertise in *Introduction to Amateur Radio*. The package includes a Complete Instructor's Manual with twenty-six lesson plans; an audio cassette for code practice; a code practice oscillator; a free videotape illustrating classroom instruction using this curriculum; and access to *Ham Radio Hotline* for customer support in using her package. The entire package is $99.95. Extra Space Code cassettes are $6.95 each, and the Code Key 1000 alone is $19.95. Quantity discounts. *Media Mentors, Inc., PO Box 131646, Staten Island NY 10313-0006. 718-983-1416.*

Number 26 on your Feedback card

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WANTED: Yaesu FT-625RD, FT-627RA, or FT-680R. Also wanted: ICOM IC-505, IC-551, IC-551D, IC-560, or IC-502A. Reasonable. Jim, 469 Jayson Avenue, Pittsburgh PA 15228. BNB815

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Heat Up the Iron

What fun! Snowed in and nothing to do! Well, have you given any thought to making some changes to your shack's radios? There is no time like the present. Let's take a look at some simple little mods for some of the more popular Heath series radios, namely the HW-8 and the HW-9 QRP transceivers.

The HW-8 continues to be a hard act to follow. There is no end to the modifications that we hams can come up with for this radio. The newer HW-9, after a few years on the market, is also coming under the gun of the QRPers' soldering irons. So let's heat up the iron, remove the screws from the HW-9, and jump right in.

Bright Ideas

In my shack, I like to know if something is on or off. My source of power is the sun, so I don't like to waste energy. Of course, neither the HW-9 nor the HW-8 has a "power on" indicator. In the HW-8, the most popular method of using a "power on" indicator is to back-light the meter by mounting a small grain-of-wheat bulb behind the meter. The meter will take on a nice soft glow.

I tried the same method on the HW-9. Guess what? It didn't work! Seems that this time around Heath has painted the back of the meter, and you can't get a light bulb to shine through. Rats!

Not being one to give up easily, I took a closer look. If you have an HW-9, remove the top case. Notice that the front panel and the inside chassis are two different pieces. Notice also the small gap between the two. Whoa! Right there is the place to install some small lights to illuminate the meter. In fact, there is room enough for a second lamp for the dial!

My junk box seemed to lack anything in the way of grain-of-wheat bulbs, so I went to the local Radio Shack. Looking over the stock that was hanging on the pegs, I came upon a pack of multicolored miniature lamps, 12 volts or 6 volts, for under two bucks per pack.

I removed the colored paint with a dab of fingernail polish remover, then I applied a small drop of Superglue™ to one side of the bulb. I mounted the bulb between the two panels just above the meter face. I also installed a second lamp just above the dial, being sure to center both lamps.

Since I had picked the 12 volt units, I wired them in parallel and ran a small piece of wire from the top side of the HW-9 to the power switch on the bottom. I followed the routing of the main cable harness leading to the bottom board. I found that the lamps generate quite a lot of light, with little heat build-up. To prevent the bulbs from being smashed if the front panel were pushed in, I installed a small rubber "foot" on the left side of the meter. This rubber "foot" acts like a shock absorber, protecting the lamps.

With both lamps running, they will draw an extra 100 mA or so. If you plan to operate the HW-9 via battery, you might want to consider installing a switch on the rear panel to turn off the lights. Also, when working with the Superglue™ be **EXTREMELY** careful when installing the lamp over the dial. You don't want to get any of the glue down inside the dial or the dial drive.

If the lamps are a bit too bright for your liking, just add a current-limiting resistor in series with the bulbs. Be sure to keep that resistor away from the heat-sensitive circuits inside the HW-9.

Audio Fixes

Now that we have some dial lights, how about two simple fixes for the audio? While you're at Radio Shack, pick up a speaker for the HW-9. It's a Radio Shack Minimus −0.03, catalog number 40-1250. I added four large rubber feet to the bottom of the speaker. The speaker is now just as high as the HW-9. The dark walnut color matches quite well with the HW-9. The speaker sounds great, and is a lot cheaper than the Heath speaker.

There is a drawback to this "fix." If you're like me, and Rod Breaux WA5OIH, you'll notice that the audio sounds "kinda funny." Rod tracked the problem down to C336 on the T/R board. Capacitor C336 couples the product detector U303 with the low-pass filter U304B. The capacitor value is not especially critical and any unit of 10 µF or less, with a voltage rating of 15 volts or more, will work fine. In my HW-9, I installed a 4.7 job and had great results. The "fix" here is to install a new capacitor, but install it **BACKWARDS** from the original way. Heath designed the circuit in reverse polarity. You'll get an increase of audio, providing a significant improvement in the signal-to-noise ratio.

Increasing Output

We now have meter and dial lamps, and better audio. How about increasing the punch of the transmitter a bit? Again, Rod comes to the rescue.

To correct for low output on 10 and 15 meters, Rod changed capacitors C563 and C566, using Arco trimmer capacitors, and made them variable. Keying the rig into a dummy load, adjust the trimmers for maximum power output. After you're done, measure the value of the trimmers and substitute silver micas for the trimmers. You'll gain 1 to 1½ Watts on 10 and 15 meters. You don't have to mess with the filters for the other bands.

The driver stage, Q404, uses inverse feedback in the form of R414 and C432. To get more drive, you increase the value of R414. Be careful—too much gain and you'll have instability in the stage. Rod suggests that you start off with 1.8k ohm and increase the resistance in steps. His HW-9 remained stable at 3.3k. I stopped at 2.7k and had a power increase to about 5 Watts on 80 meters. This modification has little effect on the higher bands, so monitor your success on 80 meters. In working with a stage with such a high FT, the transistor can become very unstable. The front power control should provide smooth output with no sudden pops or sluggish responses.

The final modification to the driver stage is to remove resistor R415 with a jumper and a ferrite bead. Again, watch for signs of instability. By careful selection of components, you'll be able to have in excess of 6 Watts output on 80 meters. Just remember, if you want to operate within the contest rules of the QRP International, you can't have an output over 5 Watts.

Drift Fixer

Seems that every HW-9 has some drift problem. My HW-9 is not too bad, and to be frank, I never worried much about it. But Rod did, and here is his fix for VFO drift.

Remove the shield can and arrange the components so that none touch each other or the shield can when it is replaced. This includes the VFO coil L118. Bend the top of the can if necessary to allow coil clearance. This is an easy fix. Also, I've been told (but haven't tried this one myself) that you should paint the inside of the shield black. This keeps drift down. It seems that the black paint will absorb the heat, and thus prevent any effects on the components.

If you still have the cover off, solder a small piece of flexible conductor (RG-174 braid, solder wick, etc.) from the tuning capacitor shield to the ground lug of adjacent AF control R3. The grounding provided by Heath is a bit lackluster!

A Simple Adjustment

When I do a modification on a radio, I always like the ones that require only an adjustment of this or that. The transmit offset adjustment is just that, an adjustment. You'll need another radio, and not the HW-8 or another HW-9. Connect the regular station radio to a dummy load. Set it up for normal CW operation and switch in the sharpest IF filter available. Next, key the rig and peak the signal in your HW-9. Be sure to have the selectivity switch in the "narrow" position. Now, unkey the station rig and key the HW-9 also into a dummy load. While it's keyed, turn R131 on the oscillator board until the signal peaks in the station rig.

That's it! You've just set the transmit offset of the HW-9. Now, when you work a contest, those ops with the super high-tech filtered rigs will be able to hear you.

There are more mods for the HW-9. And, as more and more of the QRP ops take the time to change and modify the HW-9, the list will grow. I'm in the middle of working on the third edition of the Hot Water Handbook. If there is some modification that you deem important, please drop it my way. If I use it, you'll get a free copy of the HW Handbook when it is done.

Remember, this is your column. I need your input to keep up with what you want to read about. I can always use photographs, schematics, and other goodies to share with our readers. ■

HOMING IN

Radio Direction Finding

Joe Moell PE KØOV
PO Box 2508
Fullerton, CA 92633

Let's Build a Quad

Last month I explained why gain antennas such as yagis and quads are preferred by the best southern California transmitter hunters over all other methods for competitive hunting on the 2 and 1-1/4 meter bands. Gain antennas save the day when the signal is weak, as it is when the hider runs low power from the valleys, canyons, and (occasionally) the sewers of the Los Angeles basin.

Despite all its advantages, a quad DF setup isn't expensive—in fact, it's dirt cheap and you can lash it up yourself even if you're the kind of ham who has build-ophobia. Parts are no problem even if you're miles from a radio store because you get them from your local lumberyard or hardware emporium.

This dual-band quad was developed for hunting by the late Ray Frost WA6TEY, and documented by K6BMG, N6JSX, and others. It uses 18 or 19 AWG wire strung in a diamond configuration like the photo in last month's column. If you aren't interested in hunting both bands right now, install the elements for only your band of interest.

There is an endless variety of ways to put together a strung-wire quad. WA6TEY used a wooden boom (1-3/4 X 1-3/4 X 28 inches long) and spreaders of 5/16 inch wooden doweling held in place with 4-1/2 inch lengths of 3/8 inch hard aluminum tubing from an old TV antenna. Others have built their quads with PVC pipe booms and fiberglass rod spreaders. Just remember that the boom and spreaders should be non-metallic and the mast/boom coupling should allow boom rotation to select horizontal or vertical polarization, if both are used in your area. Figure 1 shows the coax connected for vertical polarization. For horizontal polarization, the feed should go to the bottom corner.

The directors and reflectors are continuous wire loops. Break the driven element loops at the feed points and connect them to the shield and inner conductor of the coaxes as shown. To decouple the feed line, use a sleeve balun made of braid from an old piece of coax. Remove the outer jacket on the 2 meter coax 13-1/4 inches from the driven element end and solder one end of the sleeve there. Smooth the shield sleeve down over the jacket of the coax and trim it off a quarter inch from the driven element end. For 220 MHz, use a similar sleeve connected 8-5/8 inches from the driven element end. Put tape or shrink sleeving over each balun.

Be prepared to spend some time tweaking your antenna for best performance. Don't permanently fasten the spreaders to the boom or install the jumpers holding the element wires to the spreaders until you have completed your adjustments. Install the director loops first, then connect the driven element loops to the feedline, and adjust their lengths for best SWR on each band by moving the connection points of the feed line. Install reflector loops and adjust reflector and driven element lengths for best SWR.

Now set up the antenna on your vehicle in a wide open field or large, empty parking lot. Use a signal source a hundred feet or so away and check for left or right bias in the antenna pattern when DFing the source. If the quad points to the right of the source, redistribute some of the wire of the driven element for that band to the right side of the spreaders. If the pattern is biased left, redistribute wire to the left. After you have eliminated the bias on both bands, attach the element wires and secure the spreaders in place inside the aluminum tubing with crimping, setscrews, or glue.

Seal off the ends of the coax and paint your completed quad a dark color. That protects the elements and makes the setup inconspicuous on night hunts. When hunting on 2 meters, be sure to terminate the end of the 220 MHz coax with a 50Ω load, and vice versa. Otherwise, element interaction may skew the pattern.

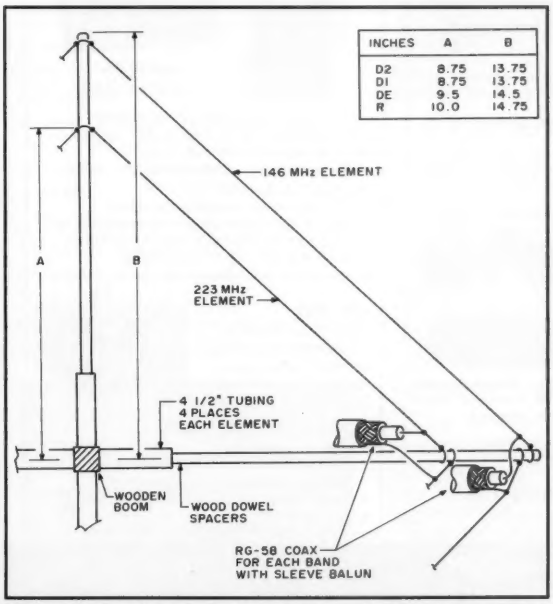

Figure 1. Element details of the dual-band quad. Elements are symmetrical and only one quadrant is shown. Holes to string the wires are at distances A and B from boom center on each spreader, per the table.

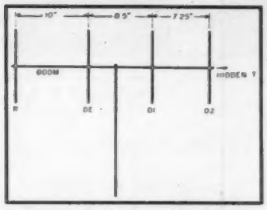

Figure 2. Side view showing how the elements are located on the boom. Elements are the reflector (R), driven element (DE), and two directors (D1 and D2).

Beams Aren't Perfect

It should come as no surprise that there's no VHF DF system that's best for all situations. Beams do have their disadvantages on mobile hunts. They're cumbersome, particularly if you have to get out of the mobile and hunt on foot to close in. That full-size yagi or quad can get pretty heavy after a few hundred yards!

Beam hunters must remember to swing the beam in a full 360 degree circle regularly, or they may miss a sudden shift in signal to the rear as the hidden T is passed. For this reason, beam hunting works best when there are three hunters in the car. The driver concentrates on the road, the DFer swings the beam and gets bearings, and the navigator watches the maps.

Beams have good directivity and front-to-back characteristics only over a relatively narrow frequency range. A 2 meter quad won't work well for aircraft search and rescue on 121.5 MHz or on the VHF marine band. You need a separate beam for each band where you want to hunt.

Most mobile hunters use three or four element yagis or quads on 2 meters because longer ones get too unwieldy at high speeds. The trade-off is that short beams are too broad to give high resolution. The 3 dB beamwidth of a four element quad is more than ± 30 degrees, requiring careful aiming to determine where the exact signal peak is. It's even harder when there are mobile fluctuations.

There are even a few hunting situations when the beam/S-meter method works so poorly it can drive you crazy. A good example is the hunt put on at the 1986 ARRL National Convention in San Diego.

Instead of transmitting continuously, the fox went on for a half-second, then off for a half-second, over and over. As if that were not tough enough on hunters trying to get signal strength readings with a bouncing S-meter, the automatic transmitter controller set the output power to a different randomly-selected level (from a hundred milliwatts to a hundred Watts) for each half-second burst.

When signal strength information is more confusing than helpful, a RDF system which does not depend on relative amplitude is needed. Such systems exist, and they have other advantages as well. We'll begin discussing them next time.

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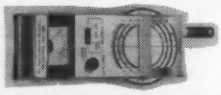

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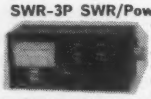

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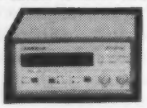

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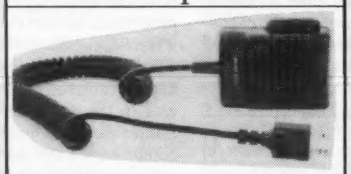

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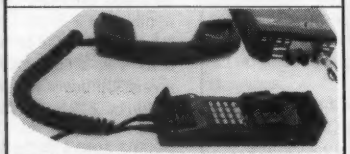

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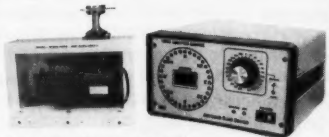

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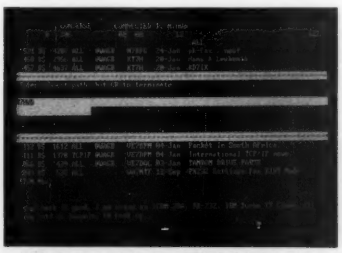
The PK-232 should be listed in the amateur radio dictionary under the word Versatile. One data controller that can transmit and receive in six digital modes, and can be used with almost every computer or data terminal. You can even monitor Navtex, the new marine weather and navigational system. Don't forget two radio ports for both VHF and HF, and a no compromise VHF/HF/CW internal modem with an eight pole bandpass filter followed by a limiter discriminator with automatic threshold control.

The internal decoding program (SIAM[tm]) feature can even identify different types of signals for you, including some simple types of RTTY encryption. The only software your computer needs is a terminal program.



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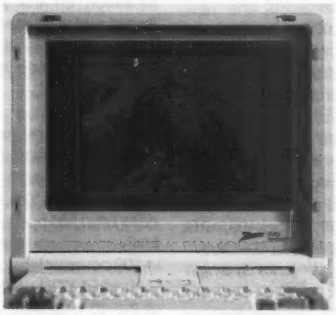

Facsimile Screen Display

2 Software Support

While you can use most modem or communications programs with the PK-232, AEA has two very special packages available exclusively for the PK-232....PC Pakratt with Fax for IBM PC and compatible computers, and Com Pakratt with Fax for the Commodore 64 and 128.

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73 INTERNATIONAL

edited by C.C.C.

Notes from FN42

The Index (International) for 1988 *is in two parts. For an index by nations, see box; an index by major subjects is here:* ***Esperanto****—July;* ***World****—ITU items, July, November;* ***Universal Permit Application****—January, February, March, October. (For the index by nations for issues from April 1983 through 1987, see page 97 in the January, 1988, issue.)*

Ambassador *Barry Goldwater K7UGA*—*courtesy of Advanced Electronic Applications, Inc. (see photo). Barry received the third annual Amateur Ambassador Award from AEA at the ARRL National Convention last September. The $1,000 check which came with the award was immediately endorsed over to the ARRL by K7UGA, where it will be applied to the Fund for the Defense of Amateur Radio Frequencies. Nominations for the 1989 award (which is international in scope) may be made on forms available from AEA, PO Box C2160, Lynnwood, WA 98036-0918, USA. Nominees are judged on the criteria of dedication to amateur radio, positive influence on those outside the amateur service, and initiation of special projects or programs to promote the amateur service. Previous winners were Mary Duffield WA6KFA and Byron Lindsey W4BIW.*

February calendar: 2—Groundhog Day, USA; 4—Independence Day, Sri Lanka (7th for Grenada, 18th for Gambia, 22nd for St. Lucia, 27th for the Dominican Republic); 5—Anniversary of the Constitution, Mexico; 6—New Zealand Day (Watangi); Tet, Vietnam; Chinese New Year (Hsin Nien)–Year of the Snake begins; 8—1968 Revolution Day, Iraq; 11—Commemoration of the Founding of the Nation, Japan; Youth Day, Cameroon; National Holiday, Iran (23rd for Gambia and Brunei, 25th for Kuwait); 14—Valentine's Day, Race Relations Day, USA; 18—Democracy Day, Nepal; 19—Brotherhood Week begins, USA; Mothering Day, Great Britain; 20—Lantern Festival, China; President's Day, USA; 22—Washington's Birthday; 25—Victory Day, Czechoslovakia; 28—Kalevala Day, Finland.

Roundup

USSR. *Confused?* Some of the information about the new West Siberia DX Club and its new awards program has been confusing, some contradictory. We suggest you respond to this message received by us: "The club welcomes inquiries from individuals and other clubs worldwide regarding the Club programs and activities. Please direct inquiries to: USSR, 644099, Omsk–99, PO Box 836, West Siberia DX Club." [***NOTE:****That's the order in which address units appear in the USSR. For the convenience of both US and USSR postal personnel, it is suggested that whatever order you use, place each unit on a separate line and print VERY carefully.—CCC*]

The latest information we have: It is not necessary to be a WSDX Club member to qualify for the awards. And see the boxes for information on the Arctic Ocean Award and a revised list of cities for the USSR 1,000,000 Cities Award reported on in last month's 73 International.

World: Esperanto. Fakuloj pretendas, ke preskaŭ iu ajn persono povas lerni Esperanton en cent horoj aŭ malpli. Yes, they do! *Who does what?* Experts, who say: virtually anyone can learn Esperanto in 100 hours or less.

How did YOU do (if you are one of the 33 who took advantage of the free-lessons offer made through this column)? *(July, 1988, p. 91)* The 33 were from 20 different states, including four Ohioans (Ohioers?), and at least one did all of the ten free lessons—will he/she write and tell us how it goes on the air? The offer is still open, according to Esperanto enthusiast Allan C. Boschen; and in response to comments made by some of the 33, a new compilation has been made of all words used in lessons 1 through 4 (accompanies lesson 2), lessons have been improved, and a tape is being prepared with lesson-conversations and songs, so one can learn what Esperanto sounds like. (A nominal charge, only for the tape, if requested, will be made.) If interested: Send a business-size SASE (SAE with IRCs if you write from outside the USA) to **Esperanto STI, 195 Partridge Road, Pittsfield, MA 01201, USA** for the first of the ten free lessons. Return each lesson for correcting, with another SASE (or SAE with IRCs) for the next one.

World: Asia Telecom 89. The International Telecommunications Union and Telecommunications Authority of Singapore are sponsoring "Asia Telecom 89" in Singapore, 20–25 February, with exhibition and forum at one place, in Raffles City, at the Westin Stamford and Plaza. The forums, workshops, and exhibits are for telecommunications specialists,

INTERNATIONAL INDEX FOR 1988

(Includes "Roundup" and "Notes from FN42" references)

Africa (General)—Jul; **Argentina**—Feb; **Australia** (See also Norfolk Island)—Feb, Mar, Apr, Jun, Jul, Nov,; Dec; **Belgium**—Feb; **Brazil**—Feb, July, Aug; **British West Indies**—Jan, Jul; **Canada**—Mar, Jun; **Chile** (See also Easter Island)—Feb; **China**—Jan, Aug, Nov; **Cyprus**—Mar, Oct; **Czechoslovakia**—Mar, Jun; **Dominican Republic**—Sep; **Easter Island**—May; **Ecuador**—Mar; El Salvador—Sep; **Finland**—Jun; **France**—Jun, Jul; **Great Britain**—Jan, May, Jul, Nov; **Germany (West)**—Sep; **Greece**—Mar, May; **Hong Kong**—Apr, Jun; **Ireland**—Apr, Nov; **Israel**—Feb, Mar, May, Jun, Aug, Nov, Dec; **Italy**—Jan, Apr; **Japan**—Jan, Apr, Oct, Dec; **Kenya**—Nov, Dec; **Korea (South)**—Feb, Mar, Jun, Sep, Oct; **Liberia**—Apr; **Malaysia**—Sep; **Mexico**—Oct; **Netherlands**—May, Nov; **New Zealand**—Feb, May, Jul, Aug; **Norfolk Island**—Apr, Oct, Nov; **Philippines**—May; **Poland**—May, Aug; **Portugal**—Jun, Jul; **Russia (See USSR)**; **San Marino**—Jan; **South Africa**—Nov; **Sweden**—Feb, Jun; **Taiwan**—Mar, May; **Thailand**—Jul; **Togo**—Oct; **USSR**—Mar, May, Aug, Sep, Dec; **Vanuatu**—Sep.

Barry Goldwater (right) receives the 1988 International Amateur Ambassador Award from Mike Lamb N7ML, President of AEA, Inc. See text for 1989 nomination process. (Photo by Bob Kuhn KC7YN)

WESTERN SIBERIA ARCTIC OCEAN AWARD

Requires QSO/SWL with amateurs of the following (numbers in parentheses are oblast' numbers):

JW—Spitzbergen	UA1—FJL	UA0—Severnaya Zemlya
Bear Island	Novaya Zemlya	Novosibirskiye Islands
JX—Jan Mayen	UA1N—(088)	Wrangel Island
KL7—Alaska	UA1O—(113)	UA0B—(105)
LA—Norway	UA1P—(114)	UA0K—(139)
OX—Greenland	UA1Z—(143)	UA0Q—(098)
VE—Canada	UA9K—(163)	

Three contacts with Soviet Polar Drifting stations (UP0L, 4K0, etc.) may be substituted for any of the above.

Class I—20 contacts, no two with same area.
Class II—15 contacts, no two with same area.
Class III—10 contacts, no two with same area.

QUALIFYING CITIES FOR U-1 000 000-C AWARD

(See January 73 International USSR Report)

Alma-Ata	Kiev	Omsk (•)
Baku	Kuibyshev	Perm
Chelyabinsk	Leningrad	Sverdlovsk
Dnepropetrovsk	Minsk	Tashkent
Donetsk	Moscow	Tbilisi
Gorky	Novosibirsk	Ufa
Kazan	Odessa	Yerevan
Kiev		

(•) Omsk is required for any class of this award.

QSL TIDBITS FROM NT2X

(See under USSR in "Roundup" for note on forms of address in the USSR)

Any who still need QSL cards from 4K1A, 4K1HK, 4K1ANO, 1980 to 1987, may write for them from USSR, 127349, Moscow, PO Box 459, Toivo Lamitainen RA3AR *** RA9YD willing to help obtain ANY Soviet QSL cards and send airmail. Send request with 3 IRCs to USSR, 656057, Barnaul, PO Box 2353, Valery Tyulyapin RA3AR *** UQ2GAG has the 4K1GAG operation logs. If in need of a QSL, send your card with 2 IRCs to USSR, 226010, Riga, PO Box 50 *** UW1ZC has the logs for the 4K1CEY operation. Mail your correspondence to USSR, 184360, Murmanskaya oblast', Kola, PO Box 70 *** Alex Vedernikov UA9YAB is willing to become a QSL Manager for any North American station or radio club and help facilitate QSL exchange between them and USSR stations. He has logs for UK9ZAA, UA9ZAA, UK9YBD/U9Z, UZ9YWA/U9Z, UZ9ZWA/U9Z, and can help with other QSLs. IRCs will be appreciated. Address: USSR, 659303, Altaisky Krai, Biysk, PO Box 83.

service providers and users, manufacturers, investors, and economists from around the world. The theme will be: Moving into the Information Age: Integrated Telecommunications Services and Networks.

AUSTRALIA

Following is Part II of the report sent in by Jim Joyce VK3YJ which we have entitled "Four Men and an Island—Weather from Beyond the Outback." Part I appeared in the December, 1988, issue.

Amateurs on Willis Island. One early amateur was John VK4JQ, who operated both phone and CW in late 1963. Mid-1964 saw VK4WV active on CW, and the DX column in the WIA journal, *Amateur Radio,* for November, 1967, notes that "Willis Island's John VK4HG [is] having a few minor troubles. On the last air drop his 10 and 15m gear went into the drink beyond the reef. So look for John now only on 20 SSB 0900 and 2000Z."

Gavin VK4EV (now VK3HY) spent some time on the island in 1968 and enjoyed around 1500 contacts while using a home-brew phasing-type transmitter with an output of 50 Watts PEP, to a ground plane on 20 meters, a half-wave dipole on 80 meters, and a two-element beam for 6 meters. His receiver also was home-brew. After his return home, Gavin received QSL cards direct and through the Bureau for nearly ten years.

Gavin's period of duty missed out on the cyclone season, but an earlier team had the stimulating experience of cyclonic winds clocked at 108 knots. This is still the record for wind strength in Eastern Australia, and the team was very happy to have the concrete bunkers built for such occasions, provisioned with basic necessities.

One popular amateur was Kevin VK9ZC (now VK4AKC). He arrived in 1973 with a new license, an FT-101, materials to make a quad, and lots of enthusiasm. The big opportunity for team members to talk with those back home made amateur radio an instant hit and a hobby for everyone there. In fact, the team relieved him of rostered duties for the 24 hours of the RD contest, with his promise that he'd stay on the mike. He endured, and the team waited on him hand and foot with nourishment and encouragement. The result? He won the VK9 segment of the contest!

Kevin had over 2400 DX contacts during his stay, even though many of them involved heavy going. Whenever he went on the air the whole world wanted to work him for a new country, and as he worked only transceive, it could take him up to 15 minutes to acknowledge one call. QSLs were handled promptly, however, as he transferred log data to his manager day by day. Kevin made friendships worldwide.

Kevin's popularity wasn't hurt any by his contribution to TV reception. His interest in VHF decided him that the spasmodic images from Townsville could be improved by a "VK9ZC Special," a 6-element yagi with a mast-head amplifier. Results were disappointing, so he constructed an 11-element yagi. Results were promising, but he estimated that at least another 10 dB of signal was needed for consistent viewing.

There followed a period of construction of antennas with exotic designs, and various longwires and vees, with enthusiastic help in their erection and testing. Finally, a stacked rhombic with a 200-foot-long axis won the day. TV viewing with watchable signals became possible about five nights per week, providing much entertainment to the population of lonely Willis Island.

[*The Willis Island story concludes with Part III, to come.—Ed.*]

Willis Island—a sea-level view.

CANARY ISLANDS
(Spain)

Woodson Gannaway N5KUB/EA
Apartado 11
35450 Santa Maria de Guia
Las Palmas de Gran Canaria
Islas Canarias, Spain

The Canary Islands are a group of seven normally recognized ones and several smaller, seldom mentioned islands. All are located close to the northwest coast of Africa. They form two provinces of Spain, and of course everybody speaks Spanish. Even if someone native to the islands can speak good English, it is really appreciated if you speak in Spanish. I find them very helpful in slowing down to accommodate my imperfect Spanish.

We have lived here over a year and a half, and I had my license to operate (temporary, good for one year) six weeks after applying. The process is pretty straightforward if you speak Spanish. I applied in person at the Telecommunications Office; it cost about 1800 pesetas (around US $15).

I had been advised to bring my rig; and I advise you the same, and bring it complete because you won't know what you can find if you need something. Part of the application procedure requires asking for permission from the *Communidad,* the building management committee, if you plan to erect an antenna in a part of your building other than your own apartment. If you apply by mail, you could perhaps plan a small vertical from the balcony. Allow lots of time if you apply by mail! But be sure to apply; this is a great place to operate!

Last July the amateur radio operators from the island of Fuertaventura travelled to El Hierro [*about 200 miles to the west, the most western of the Canaries—CCC*], on what was said to be the

first expedition away from the major islands. It was authorized by the General Director, Telecommunications, and the special callsigns, ED8EIH, EE8EIH, and EF8EIH were issued for use during July. A distinctive QSL card was made up.

NEW ZEALAND

Des Chapman ZL2VR
459 Kennedy Road
Napier
New Zealand

Kia ora atu i Aotearoa— Hello from New Zealand! Welcome to CCC as the new editor of 73 International!

I have submitted the specimen **73 International Universal Permit Application** to the authorities for their perusal and suggestions and, I hope, approval. I have also sent copies to NZART Headquarters for Council comments. The form appears to cover all the present requirements listed in the ZL Visitor permit application form.

The term **"user pays" seems to be rearing its ugly head** in many places and countries now. I noted in a recent publication that the "sale of spectrum," the stuff we use every time we throw the big switch, was the subject of renewed efforts by President Reagan to charge "users" for access to the radio spectrum by making provision in the 1989 budget for "it" to be auctioned. However, from our point of view, amateur radio was protected because public safety services and Amateur Radio would be exempt.

Here in ZL we are facing the user-pay syndrome too, not the sale of spectrum although this could come, but with regard to the use of prime sites owned by organizations and companies where amateur radio has acquired rights to place their VHF/UHF repeaters—and now owners are seeking the right to charge annual rentals. If this works out and fees are high, it is probable that the number of repeaters will diminish accordingly. It is easy to look back at the good old days in ZL when the license was $6 and we had big hunks of spectrum for recreation "as of right," but we must look forward to the '90s and devise strategies to justify the hobby use of what others see as a saleable commodity. I think we can, but must continue to lobby and bargain from here on in... which brings me to my next point: **WARC 1992.** It seems that the ITU is expected to announce that a World Administrative Radio Conference will occur then. It is essential that all amateurs arrange for the best representation at Geneva to defuse the threats to our operating frequencies and even achieve better privileges. Such representation will not be cheap but it falls to us, the members of various leagues and associations throughout the world, to finance it. NZART has been placing funds aside for this purpose ever since the last WARC, and members and clubs are presently contributing to the WARC 1992 Fund. [*Hambassadors: what are your countries doing?—CCC*]

Christmas will have come and gone by the time you read this, but all of us from down under hope you—all the hams of the world—had a merry one, and may 1989 bring about hundreds of better QSOs among us all. I look forward to sharing some of these QSOs with you.

SWEDEN

Rune Wande SMØCOP
Frejavagen 10
S–155 00 Nykvarn
Sweden

A very limited permission to operate on a new band, 50 MHz, was given last June for the SM3-VHF Meeting in Ostersund. Successful SM contacts were made with PAØRDY, PA3ECU, PA3COB, PA3DOL, and LA6QBA, and also a tropo-QSO with LA1K. This opened up the possibility for authority to operate on this band in the future. There will be a trial period since we still have national television broadcasts in this band segment. There will be 25 licenses issued for the trial period, and by the time you read this these stations certainly will be on the air. You will have a good chance to work the Nordic countries as there already are over 60 licenses issued in Finland for this band. Good luck!

DXing is gaining in popularity in the Nordic countries. No longer are we only sitting at home working the rare ones. Now quite a few LA, OH, OZ, and SM hams are travelling the world and giving the demanding DX-world new countries worked and confirmed. The DX groups are arranging DX Meetings—inviting guests from far away as well as DXpedition members from home countries. In 1987, the big thing was, of course, Peter I Island, and both Einar LA1EE and Kaare LA2GV were popular guests, and they gave fantastic slide shows. In January of 1988 the OH DXers held a big meeting outside Helsinki. Martti OH2BH showed the video recording from the famous SØRASD operation, and John W2GD talked about his operations from P4ØGD. To make the most of it for us five SM visitors and for W2GD, the talks in Finnish were interpreted simultaneously into English—an unexpected and very much appreciated effort by the organizers!

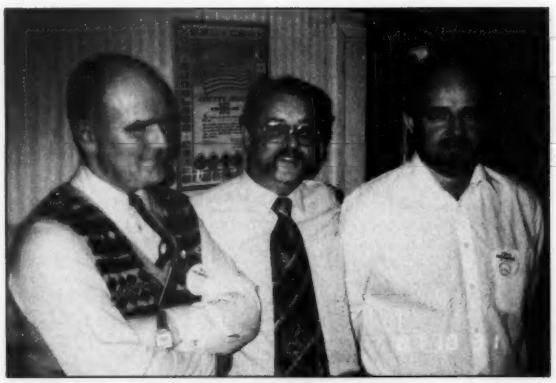
The LA DX Group had its meeting in Geilo last June, with 22 Finnish DXers and visitors from nine countries. John ON4UN and Pekka OH1RY were among the attractions.

Lake Wettern DX Group SK6WW holds the Swedish DX Meeting annually in October. The last one met in Omberg, just south of Motala on the eastern side of Lake Wettern in SM5-land. Among others, Lars SM5CAK and Osten SM5DQC worked hard with the logistics. We have quite a crowd of DXers meeting on 3775 kHz every Sunday at 1000 local time to exchange news and QSL information. It really is nice to get together at least once a year to meet old as well as new friends. SM5CAK has for years gathered information on QSL managers and probably has the most complete collection; his information is always in demand.

Stu WAA2MOE gave a slide show from the recent Palmyra and Kingman Reef DXpedition. Erik SMØAGD brought the Abu Ail DJ6SI slide show with him, that can be borrowed from the Northern California DX Foundation (NCDXF). Unfortunately there was not time enough for Erik to show pictures from his S9AGD operation of last fall. Lars SMØGMG brought the SØRASD video tape and Tord SM3EVR showed a video presentation on how packet radio can be used also by DXers. Erik W6DU gave a presentation of the NCDXF that has made many DXpeditions possible. SMØAGD was busy signing up DXers to sponsor NCDXF. Another exotic visitor was Pasi Z21GS who hopefully will soon get on the air. He studies microbiology at the University of Lund, here in Sweden, returning to Zimbabwe early this year.

These avid DXers are not always just collecting new countries. Quite a challenge for us over here is US County Hunting. SM5CAK has only about 100 left to get out of the total of 3,077. He is either on 21,387 kHz or 28,387 daily at 1430 UTC, depending on band conditions. If you read this and are in a very rare county, why not give Lars a call! Two other well known county hunters (see photo) are Rolf SM4BNZ who works primarily on CW (and has only about 100 left to work), and Hans SM6CVX (with 200 to go). Hans works only stationary ones, which is quite a task. He is on the air with Lars when time permits.

If you are planning a trip to Sweden in the fall of 1989 keep in mind that the DX Meeting, in October, will be held in Karlsbord, arranged by Kjell SM6CTQ and other members of SK6WW.



Left to right, Lars SM5CAK, Rolf SM4BNZ, and Hans SM6CVX.

system, which can slow the flow of DX information dramatically. A solution to both of these problems is the PacketCluster (PC) software, which is very similar to PCBS but lacks the bulletin board features of mail and bulletins. (Stations can send short messages back and forth, with a TALK feature, but cannot store them in the system.) PC permits several nodes to link up and share DX information. Each node needs the same hardware as a PCBS node, plus an additional Kantronics KPC-2 TNC, and another VHF FM transceiver and antenna. The second VHF packet system connects the nodes together, while the first provides local access to the system. The second system can be on another 2-meter frequency, or on another band. The northern California DX packet spotting system, for example, ties the nodes together on 220 MHz.

As far as individual users are concerned, there is no difference between PCBS and PC, except for the lack of mail functions in PC. When a user enters a DX announcement, the information rapidly spreads throughout the system. It is relayed to each node, and then on to every connected station. The DX data is stored in each node, and users can call up current or historic DX data just as easily as with PCBS. PC also includes all the other aspects of PCBS: MUF, WWV, sunrise/sunset, beam heading features, local names and locations, and so forth.

PCBS versus Voice Repeater

The PCBS (or PC) system offers several advantages over more traditional DX spotting on local voice repeaters. First, the DXer doesn't have to listen to both the HF radio and the VHF repeater monitor at the same time. The DX data from PCBS shows up on a computer screen, and the DXer can concentrate on the DX station, not the 2 meter box.

Second, PCBS eliminates the need for repeats of DX announcements. Gone are the annoying "What's that call again," or "Please repeat the frequency," requests for duplicating the announcement. The data is right on the screen in front of you!

Third, the DXer can get as general or as specific data as he or she wishes: everything, or just a single band, or even a sin- gle country, all organized by the system.

Finally, the DXer doesn't even have to be in the shack to stay current with DX. Users can access the DX data at any time, so no DXer ever needs to miss any announcements during dinner, snack breaks, or other absences from the shack. Just type SHOW/DX to see what you missed while you were out of the shack.

There is one more benefit of the PCBS system: no rag-chewers can monopolize the repeater and prevent DX announcements, as happens frequently with voice DX repeaters.

PCBS and PC come complete with extensive and detailed help files, so that users can receive more information on any feature immediately. Software documentation is also very good, and the system operator has dozens of control and status commands to modify and monitor the system. Good DX! 73

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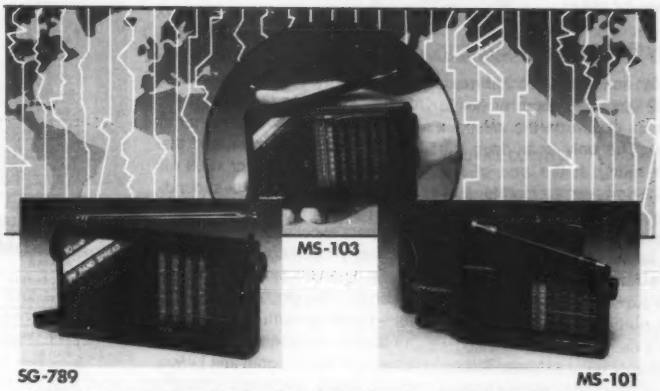

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225 Main St. Newington, CT. 06111 USA 73

PROPAGATION

by Jim Gray W1XU

Jim Gray W1XU
210 Chateau Circle
Payson AZ 85541

Daily Report for February

Daily conditions for February will be generally good, or fair to good, as shown on the calendar below. The only poor days will come along at the end of the month. However, be alert for sudden onsets of solar activity, such as flares, which can happen any time, followed by short periods of poor conditions.

We expect the sun to be fairly quiet during February, and the earth's magnetic field will also be reasonably quiet to unsettled for most of the month, except toward the end, when geomagnetic unsettled to active conditions may exist for several days.

February will exhibit the usual winter DX conditions, with fairly early band closings on the 10 and 12 meter bands as darkness falls. For a short while after dark, 15 meters will stay open, and 20 meters will be open until well after local darkness. As far as band openings in the morning, you can expect 20 meters to open first, followed by 15, 12, and 10 meters as the sun comes up and ionization extends to the higher and higher layers of the ionosphere. February is a prelude to March, which should be the best month for HF band DX since Cycle 21.

It's All Relative

As usual, the equinoxes (March and September) have better DX conditions than the solstices (December and June), while the in-between months show poorer propagation conditions. It's important to note, however, that all such things are relative, and that the worst conditions for 1989 will be far better than the best conditions just a few years ago.

Expect excellent late afternoon and early morning conditions on 40, 80, and 160 meters, to the far reaches of the globe—and best of all—these conditions will last most of the night, until midnight or after, and begin again just before dawn. Static levels will probably cause difficulties as major storm systems move across the country, particularly in the southern US and south of the equator, but these will only be temporary. Low-band HF DX will be better than ever.

Openings will occur frequently on 6 meters, and occasionally on 2 meters in February. Keep your ears open, and your radio tuned to WWV at 18 minutes after the hour for solar-terrestrial reports.

One last comment. As most of us who have been active on the HF bands know, the 10 and 12 meter bands have been outstanding for DX propagation for many months...AND IT WILL GET BETTER!

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	15	20	–	–	–	–	20	20	–	–	–	15
ARGENTINA	20	40	40	40	–	–	20	15	15	10	10	15
AUSTRALIA	15	20	20	–	40	40	40	–	–	20	20	15
CANAL ZONE	20	20	20	20	20	20	20	15	10	10	15	15
ENGLAND	40	40	40*	40*	–	20	15	10	15	20	20	–
HAWAII	15	20	–	–	–	–	20	20	20	10	10	15
INDIA	–	–	–	–	–	–	20	20	–	–	–	–
JAPAN	15	20	–	–	–	–	20	20	–	–	–	15
MEXICO	20	20	20	20	20	20	20	15	10	10	15	15
PHILIPPINES	–	–	–	–	–	–	20	20	–	–	–	–
PUERTO RICO	20	20	20	20	20	20	20	15	10	10	15	15
SOUTH AFRICA	20	40*	–	–	–	–	20	10	10	10	15	20
U. S. S. R.	–	–	–	–	–	–	20	15	20	20	–	–
WEST COAST	15/20	20/40	80	160	160	160	–	–	–	10	10	15

CENTRAL UNITED STATES TO:

ALASKA	15	–	–	–	–	–	–	20	–	–	–	15
ARGENTINA	20	20	20	40	40	–	20	20	15	10	15	15
AUSTRALIA	15	20	20	–	–	–	40	–	–	–	15	10
CANAL ZONE	15	20	40	40*	40*	–	20	15	10	10	10	15
ENGLAND	40	40	80	–	–	–	–	20	15	15	20	40
HAWAII	15	20	–	40	40	40*	40*	20	20	15	10	15
INDIA	–	–	–	–	–	–	–	20	–	–	–	–
JAPAN	15	–	–	–	–	–	–	20	–	–	–	15
MEXICO	15	20	40	40*	40*	–	20	15	10	10	10	15
PHILIPPINES	15	20	–	–	–	–	–	20	–	–	–	15
PUERTO RICO	15	20	40	40*	40*	–	20	15	10	10	10	15
SOUTH AFRICA	20	40	–	–	–	–	–	15	10	10	15	20
U. S. S. R.	–	–	–	–	–	–	–	20	15	20	–	–

WESTERN UNITED STATES TO:

ALASKA	10	15	20	–	–	–	40	40	40	–	–	20
ARGENTINA	15	20	–	40	40	–	–	20	–	10	10	15
AUSTRALIA	10	15	20	20	–	–	40*	40*	20	20	15	15
CANAL ZONE	15	20	20	–	–	–	–	20	15	10	10	10
ENGLAND	20	40	40	–	–	–	–	–	15	15	20	20
HAWAII	10	15	20	40	40	40	–	20	20	15	15	10
INDIA	–	15	20	–	–	–	–	–	20	–	–	–
JAPAN	10	15	20	–	–	–	40	40	40	–	–	20
MEXICO	15	20	20	–	–	–	–	20	15	10	10	10
PHILIPPINES	10	15/20	15/20	–	–	40	40	40	–	20	–	20
PUERTO RICO	15	20	20	–	–	–	40	40	40	–	–	20
SOUTH AFRICA	20	20	–	–	–	–	–	–	15	10	15	15
U. S. S. R.	–	–	–	–	–	–	–	–	20	20	–	–
EAST COAST	15/20	20/40	80	160	160	160	–	–	–	10	10	15

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
			1 G	2 F–G	3 F–G	4 G
5 F–G	6 F–G	7 G	8 G–F	9 G	10 G	11 G
12 G–F	13 F	14 F–G	15 G	16 G	17 G	18 F
19 F–P	20 F	21 F–G	22 G	23 G	24 G	25 G
26 G–F	27 F–P	28 P				

Forecast With Your PC

Jack Baldwin VE7RG sent me a sample program called CQFCST, which runs on the PC and Radio Shack TRS-80 Model III. He designed this program to help you forecast propagation conditions. CQFCST is a simple-minded program that rearranges K3ASK's and N4XX's forecasts by hours of the day.

Jack also has other programs for the PC and the Model III. One is MUF SCAN, that adapts MINIMUF to scan selected countries or zones, and prints out MUF for preselected hours of the day. CQINFO and CQINFO PC are menu-driven.

Jack has two mailing addresses depending upon the time of year. They are: Lakeshore Rd, Box 598, Kelowna, BC, Canada V1Y-7P2 and 2423 West Tucana St., Tucson, AZ 85745. 73

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Model	Suggested Price	Time Base Accuracy	Sensitivity Typ. 150 MHz	440 MHz	850 MHz	Digit Type Size	1 Hz Resolution	10 Hz Resolution	Inputs	Power Req.	Case Type-Size
C900	139.95	1 PPM TCXO	25 MV	35 MV		8 Digit .4 in. 7 Segment LED	10 Hz to 5 MHz	5 MHz to 512 MHz	BNC 50Ω Pre 1 Meg Dir	117 VAC 11–18 VDC 8 AA Dry Cell Batt.	All Metal RFI Shielded
C1200	169.95	1 PPM TCXO (17°–40°C)	15 MV	25 MV	35 MV	8 Digit ½ in. 7 Segment LED	10 Hz to 5 MHz	5 MHz to 1000 MHz	2 PNC 1 Meg Dir		All Metal RFI Shielded Case
C1400	199.95		5 MV	15 MV	20 MV <50 MV @ 1300 MHz	8 Digit ½ in. 7 Segment LED	10 Hz to 5 MHz	5 MHz to 1400 MHz	50Ω Pre	Optional Nicad Pk	2 x 6 x 5

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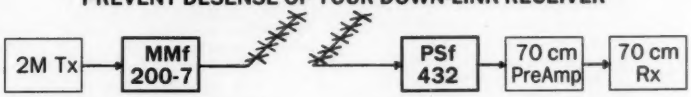

MMf200-7 (usually sufficient)	$55.00	PSf432 (for extra protection)	$95.00
I.L. @ 145 MHz	0.5dB	I.L. @ 435 MHz	0.1 dB
Loss @ 435 MHz	40 dB min	Loss @ 145 MHz	70 dB typ

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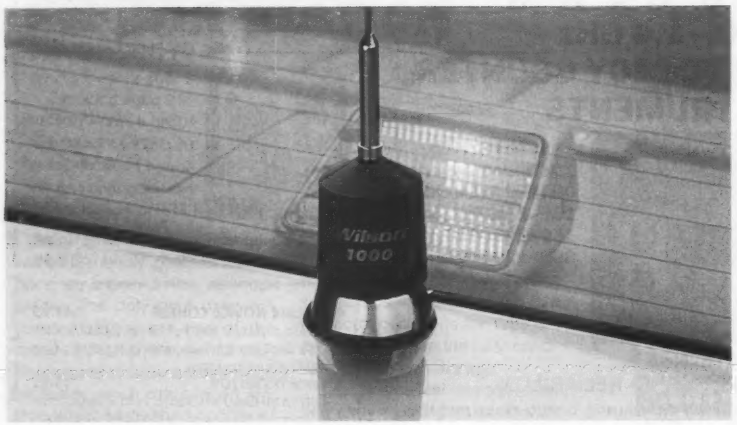

World's Most Powerful CB and Amateur Mobile Antenna*

Lockheed Corp. Test Shows *Wilson 1000* CB Antenna Has 58% More Gain Than The K40 Antenna (on channel 40).

In tests conducted by Lockheed Corporation, one of the world's largest Aerospace Companies, at their Rye Canyon Laboratory and Antenna Test Range, the Wilson 1000 was found to have 58% more power gain than the K40 Electronics Company, K40 CB Antenna. This means that the Wilson 1000 gives you 58% more gain on both transmit and receive. Now you can instantly increase your operating range by using a Wilson 1000.

Lockheed - California Company
Plant 2 Bldg. 250 Dept. 74-76
A Division of Lockheed Corporation
Burbank, California 91520

Aug. 21, 1987

Wilson Antenna Company Inc.
3 Sunset Way Unit A-10
Green Valley Commerce Center
Henderson, Nevada 89015

Subject: Comparative Gain Testing of Citizen's Band Antennas
Ref: Rye Canyon Antenna Lab File #870529

We have completed relative gain measurements of your model 1000 antenna using the K-40 antenna as the reference. The test was conducted with the antennas mounted on a 18' ground plane with a separation of greater than 300' between the transmit and test antennas. The antennas were tuned by the standard VSWR method. The results of the test are tabulated below:

FREQUENCY (MHZ)	RELATIVE GAIN (dB)	RELATIVE POWER GAIN (%)
26.965	1.30	35
27.015	1.30	35
27.065	1.45	40
27.115	1.60	45
27.165	1.50	41
27.215	1.60	45
27.265	1.75	50
27.315	1.95	57
27.365	2.00	58
27.405	2.00	58

OPERATES FROM 26 TO 29 MHz

IDEAL WITH HR2510

58% MORE POWER GAIN THAN THE K40

A complete description of this test is contained in file #870529. Excerpts of this report are enclosed.

Louis Wilson, Antenna Engineer
Electromagnetics Laboratory

Approved:
W. C. Weikel, Group Engineer
Antenna/ATS Support Laboratory

Guaranteed To Transmit and Receive Farther Than Any Other Mobile CB Antenna or Your Money Back**

New Design

The Wilson 1000 higher gain performance is a result of new design developments that bring you the most powerful CB base loaded antenna available.

Why Wilson 1000 Performs Better

Many CB antennas lose more than 50% of the power put into them. The power is wasted as heat loss in the plastic inside the coil form and not radiated as radio waves.

We have designed a new coil form which suspends the coil in air and still retains the rigidity needed for support. This new design eliminates 95% of the dielectric losses. We feel that this new design is so unique that we have filed a patent application on it.

In addition, we use 10 Ga. silver plated wire to reduce resistive losses to a minimum.

In order to handle higher power for amateur use, we used the more efficient direct coupling method of matching, rather than the lossy capacitor coupling. With this method the Wilson 1000 will handle 1500 watts of power.

The Best You Can Buy

So far you have read about why the Wilson 1000 performs better, but it is also one of the most rugged antennas you can buy. It is made from high impact thermoplastics with ultraviolet protection. The threaded body mount and coil threads are stainless steel; the whip is tapered 17-7 ph. stainless steel. All of these reasons are why it is the best CB antenna on the market today, and we guarantee to you that it will outperform any CB antenna (K40, Formula 1, you name it) or your money back!

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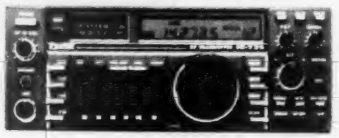

IC-735	List	Jun's
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IC 3200 A	$649.95	479.95
220 MHz		
IC–3AT	349.95	269.95
IC-38A 25w FM Xcur	489.95	349.95
IC-03AT		269.95
440-MHz		
IC-4AT	349.95	259.95

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220 MHz	429.95	239.95
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DUAL BAND		
FT-727 R 2m/70cm HT	439.95	359.95
FT-109 RH-HT	399.95	239.95

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CIRCLE 272 ON READER SERVICE CARD

YAESU'S DUAL BANDER GOES PLACES OTHER MOBILES DON'T.

FT-4700RH control head
(1 15/16" x 5 7/8" x 1")

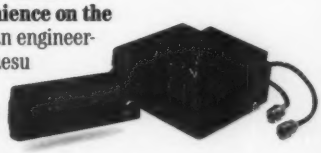
Introducing Yaesu's FT-4700RH dual-band mobile. Choose Yaesu's FT-4700RH, and you open the door to a lot of tight spaces.

While other dual banders just won't fit in today's small cars, the FT-4700RH utilizes a versatile "remote head" design. So you can mount the "brains" on your dash, visor, or door, and hide the "muscle" under your seat.

High-performance package. Packing a solid 50-watt punch on 2 meters (40 watts on 70 cm), the FT-4700RH includes Dual-Band Watch for simultaneous monitoring of both bands, with independent squelch settings on the main and secondary bands. When you transmit, opposite band monitoring goes on in a full-duplex mode.

You can adjust the relative volume of the two receive channels with the balance control, too. And with Yaesu's bright LCD display, transceiver status is clearly visible in sunlight or shade.

Convenience on the road. Human engineering, long a Yaesu specialty, is an important aspect of the FT-4700RH design. The ten-button front panel keypad includes a "do-re-mi" audible command verification, and all important controls are backlit for night operation. Plus you get extended receive coverage of 140-174 MHz (MARS/CAP permit required for transmit on 140-150 MHz), or 430-450 MHz on 70 cm. Nine memory channels on each band. High/low power selection (low power: five watts). One-touch reverse repeater shift button. Optional CTCSS module. And 16-key DTMF microphone.



Optional accessories. FTS-8 CTCSS unit. MH-15D8 Autodialer Microphone with 10-telephone number memory. SP-3 or SP-4 External Speakers. And YH-1 Headset/Boom Mic or MF-1A3B Flex-Arm Boom Mic, both with SB-10 PTT Switch Unit.

Discover Yaesu's FT-4700RH today. And see what "high performance" really means. For dual-band mobile operation, Yaesu's FT-4700RH really fits!

Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. **Repair Service:** (213) 404-4884. **Parts:** (213) 404-4847. Prices and specifications subject to change without notice. Specifications guaranteed only within amateur bands.

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CIRCLE 165 ON READER SERVICE CARD

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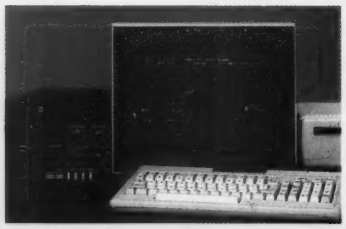
All New Compact HF!

"DX-citing!"

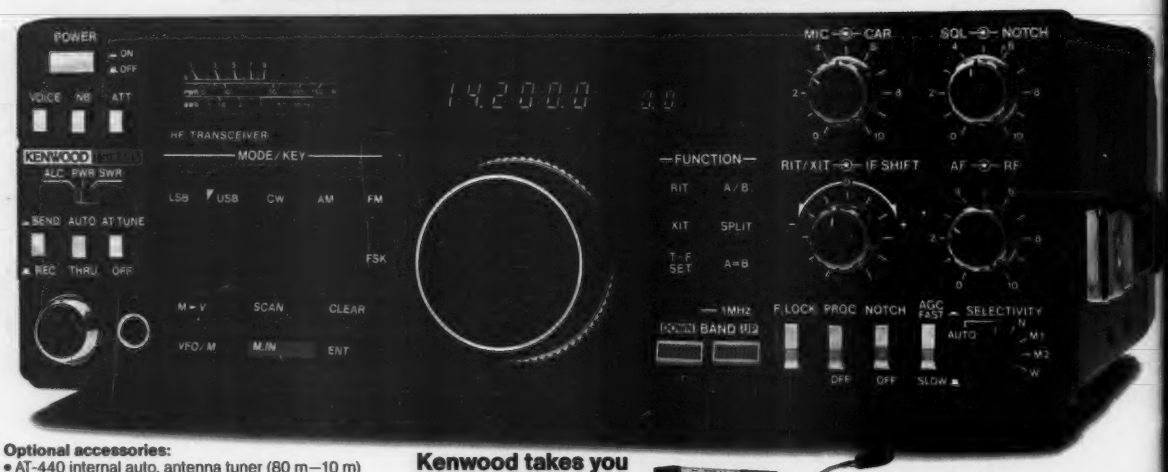
TS-440S Compact high performance HF transceiver with general coverage receiver

Kenwood's advanced digital know-how brings Amateurs world-wide "big-rig" performance in a compact package. We call it "Digital DX-citement"—that special feeling you get every time you turn the power on!

- **Covers All Amateur bands**
  General coverage receiver tunes from 100 kHz—30 MHz. Easily modified for HF MARS operation.
- **Direct keyboard entry of frequency**
- **All modes built-in**
  USB, LSB, CW, AM, FM, and AFSK. Mode selection is verified in Morse Code.
- **Built-in automatic antenna tuner (optional)**
  Covers 80-10 meters.
- **VS-1 voice synthesizer (optional)**
- **Superior receiver dynamic range**
  Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range. (500 Hz bandwidth on 20 m)
- **100% duty cycle transmitter**
  Super efficient cooling permits continuous key-down for periods exceeding one hour. RF input power is rated at 200 W PEP on SSB, 200 W DC on CW, AFSK, FM, and 110 W DC AM. (The PS-50 power supply is needed for continuous duty.)



- **Adjustable dial torque**
- **100 memory channels**
  Frequency and mode may be stored in 10 groups of 10 channels each. Split frequencies may be stored in 10 channels for repeater operation.
- **TU-8 CTCSS unit (optional)**
- **Superb interference reduction**
  IF shift, tuneable notch filter, noise blanker, all-mode squelch, RF attenuator, RIT/XIT, and optional filters fight QRM.
- **MC-43S UP/DOWN mic. included**
- **Computer interface port**
- **5 IF filter functions**
- **Dual SSB IF filtering**
  A built-in SSB filter is standard. When an optional SSB filter (YK-88S or YK-88SN) is installed, **dual** filtering is provided.
- **VOX, full or semi break-in CW**
- **AMTOR compatible**



Optional accessories:
• AT-440 internal auto. antenna tuner (80 m—10 m) • AT-250 external auto. tuner (160 m—10 m) • AT-130 compact mobile antenna tuner (160 m—10 m) • IF-232C/IC-10 level translator and modem IC kit • PS-50 heavy duty power supply • PS-430/PS-30 DC power supply • SP-430 external speaker • MB-430 mobile mounting bracket • YK-88C/88CN 500 Hz/270 Hz CW filters • YK-88S/88SN 2.4 kHz/1.8 kHz SSB filters • MC-60A/80/85 desk microphones • MC-55 (8P) mobile microphone • HS-5/6/7 headphones • SP-40/50B mobile speakers • MA-5/VP-1 HF 5 band mobile helical antenna and bumper mount • TL-922A 2 kw PEP linear amplifier • SM-220 station monitor • VS-1 voice synthesizer • SW-100A/200A/2000 SWR/power meters • TU-8 CTCSS tone unit • PG-2S extra DC cable.

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